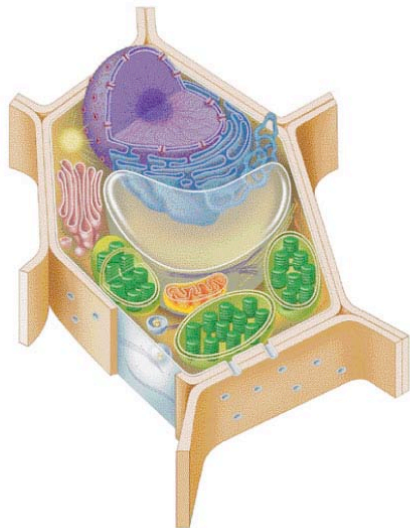
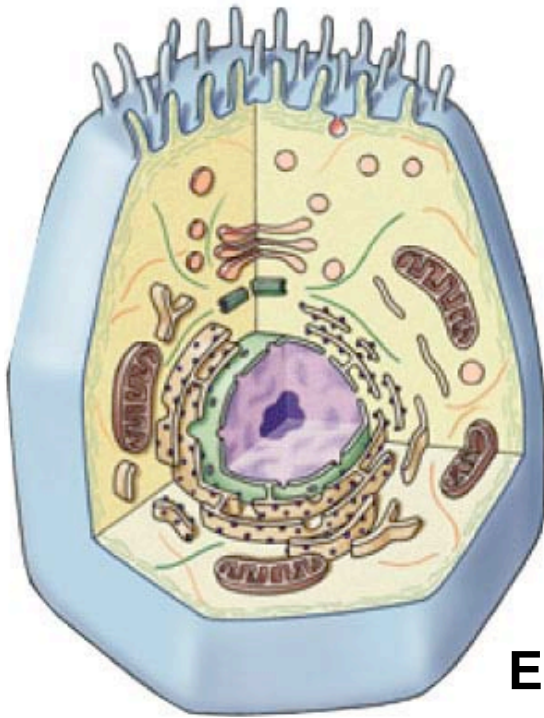


Cells & Cell Organelles

The Building Blocks of Life



Types of cells

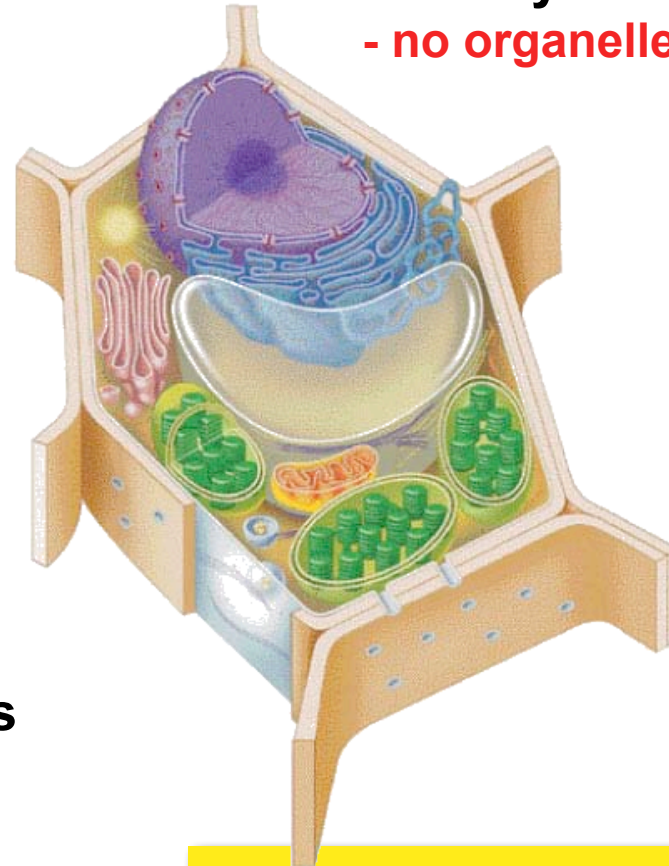
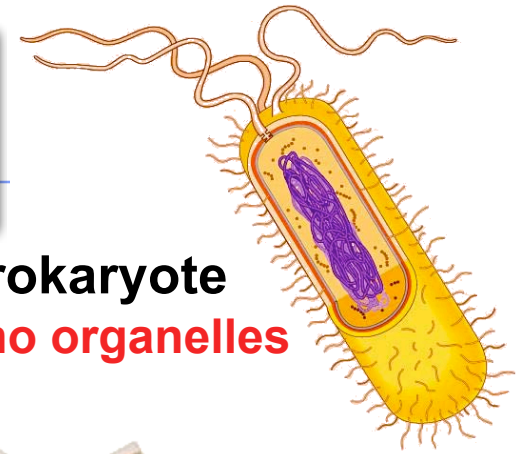


Eukaryotes
- organelles

animal cells

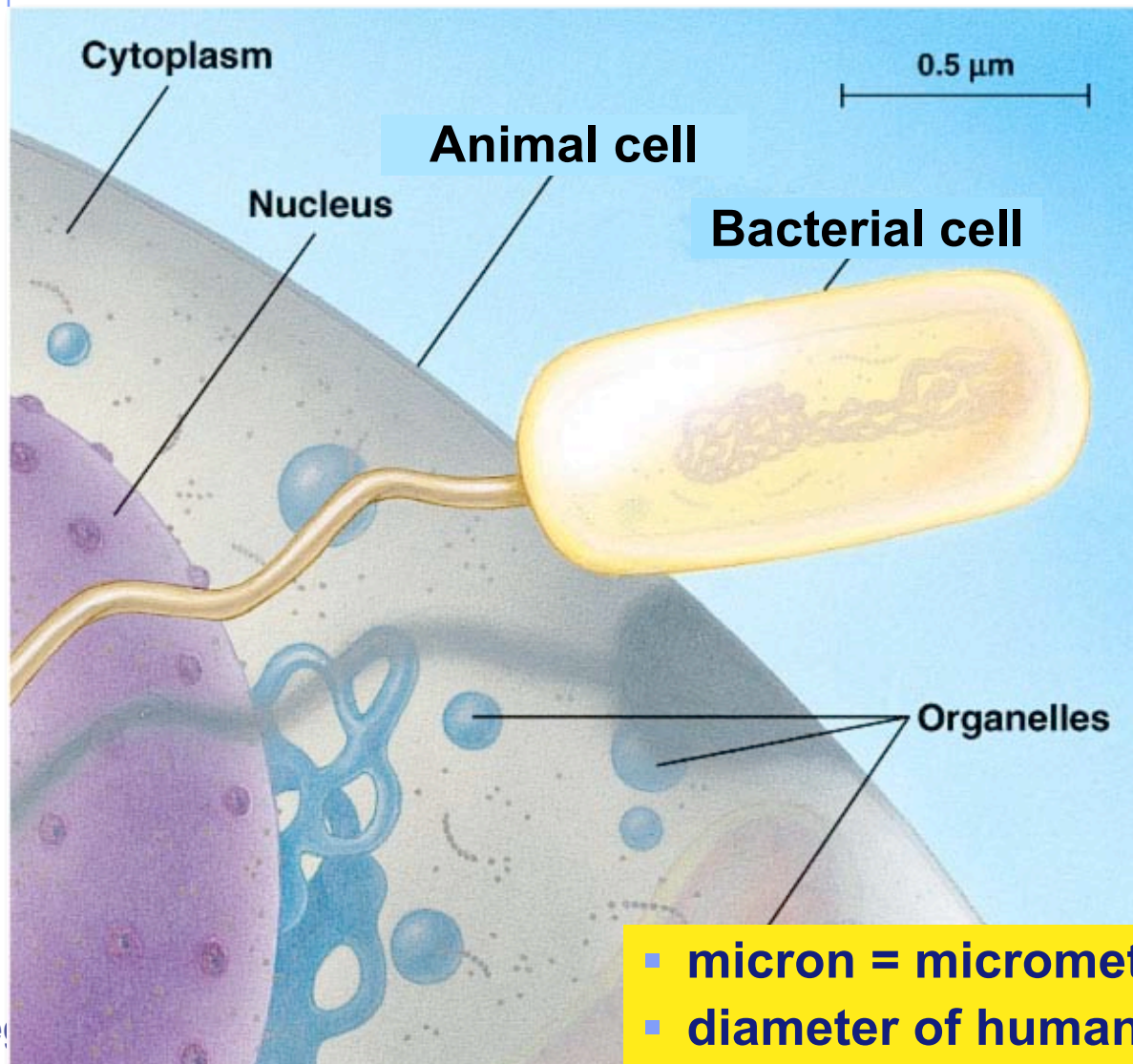
**bacteria
cells**

Prokaryote
- no organelles



plant cells

Cell size comparison

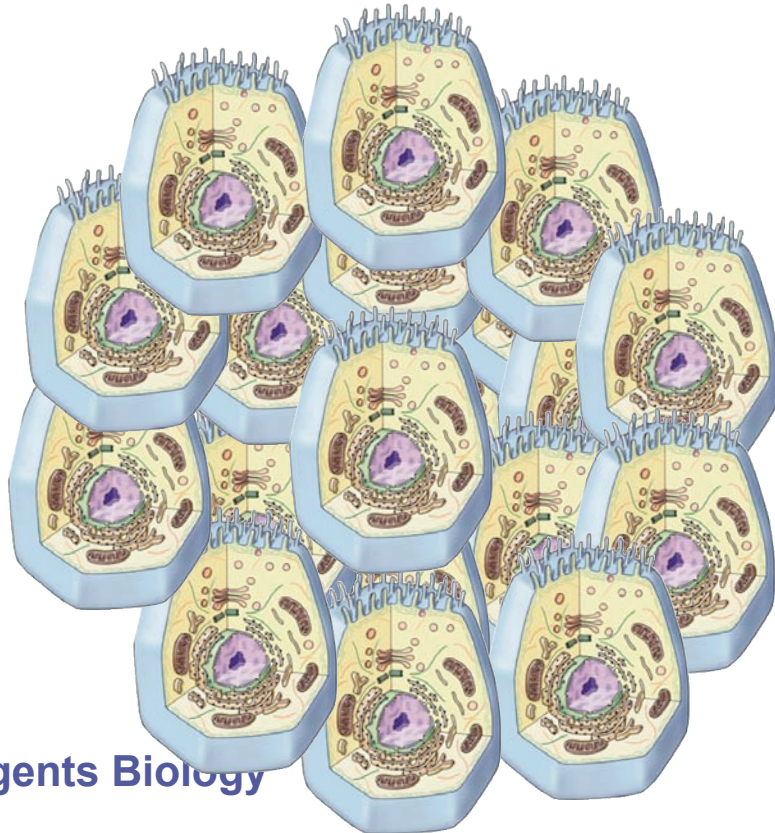


- most bacteria
- 1-10 microns
- eukaryotic cells
- 10-100 microns

- micron = micrometer = 1/1,000,000 meter
- diameter of human hair = ~20 microns

Why study cells?

- Cells → Tissues → Organs → Bodies
 - ◆ bodies are made up of cells
 - ◆ cells do all the work of life!



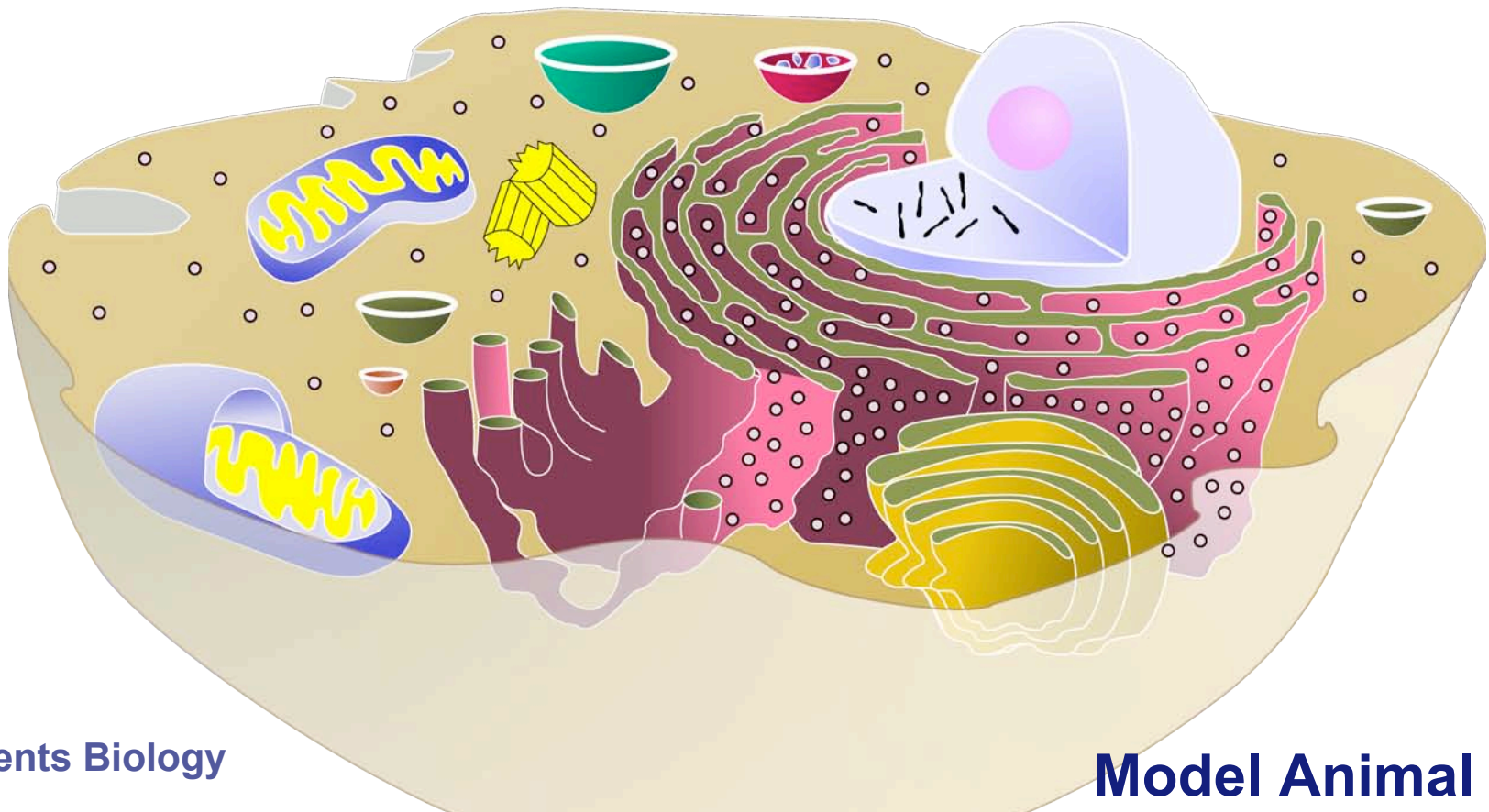
The Work of Life

- What jobs do cells have to do for an organism to live...
 - ◆ “breathe”
 - gas exchange: CO₂ vs. O₂
 - ◆ eat
 - take in & digest food
 - ◆ make energy
 - ATP
 - ◆ build molecules
 - proteins, carbohydrates, fats, nucleic acids
 - ◆ remove wastes
 - ◆ control internal conditions
 - ◆ respond to external environment
 - ◆ build more cells
 - growth, repair, reproduction & development



Organelles

- **Organelles do the work of cells**
 - ◆ each structure has a job to do
 - keeps the cell alive; keeps you alive



Cells need power!

■ Making energy

◆ to fuel daily life & growth, the cell must...

- take in food & digest it
- take in oxygen (O_2)
- make ATP
- remove waste

ATP

◆ organelles that do this work...

- cell membrane
- lysosomes
- vacuoles & vesicles
- mitochondria



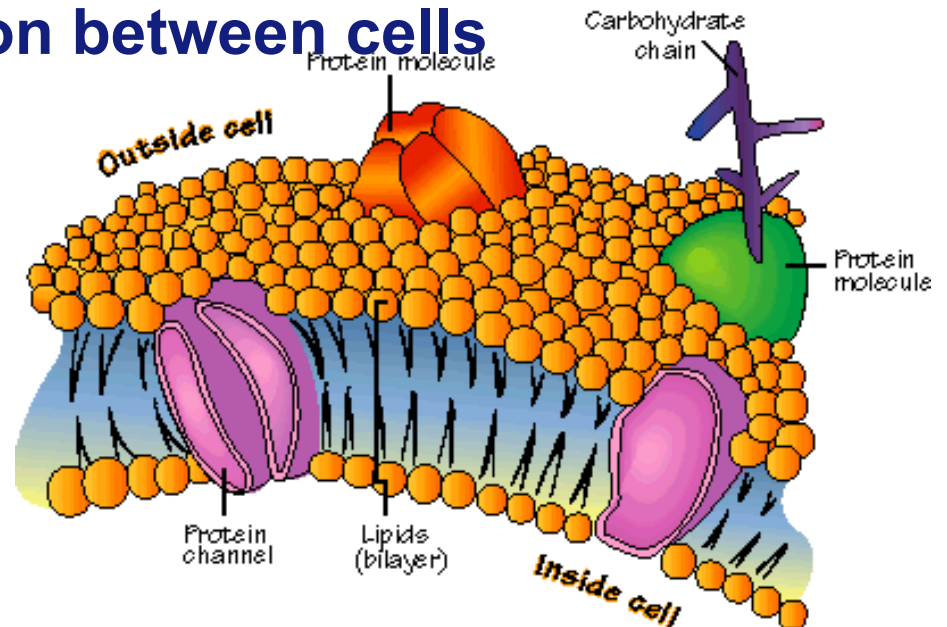
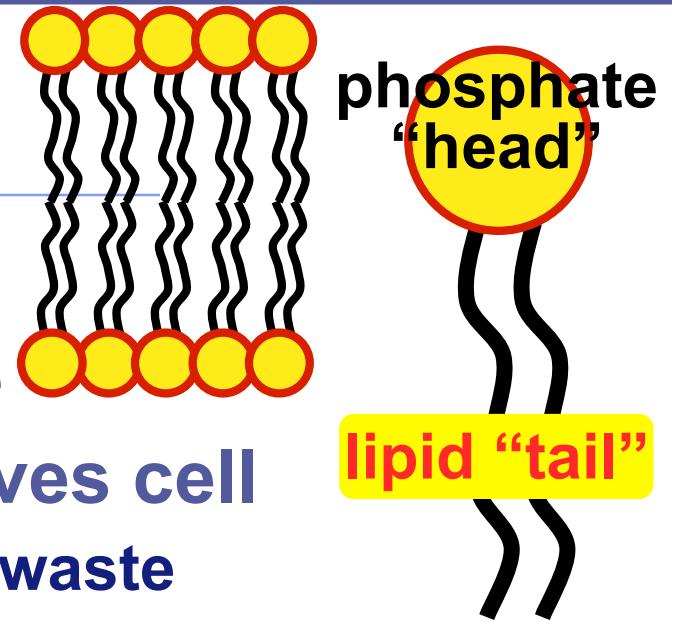
Cell membrane

■ Function

- ◆ separates cell from outside
- ◆ controls what enters or leaves cell
 - O_2 , CO_2 , food, H_2O , nutrients, waste
- ◆ recognizes signals from other cells
 - allows communication between cells

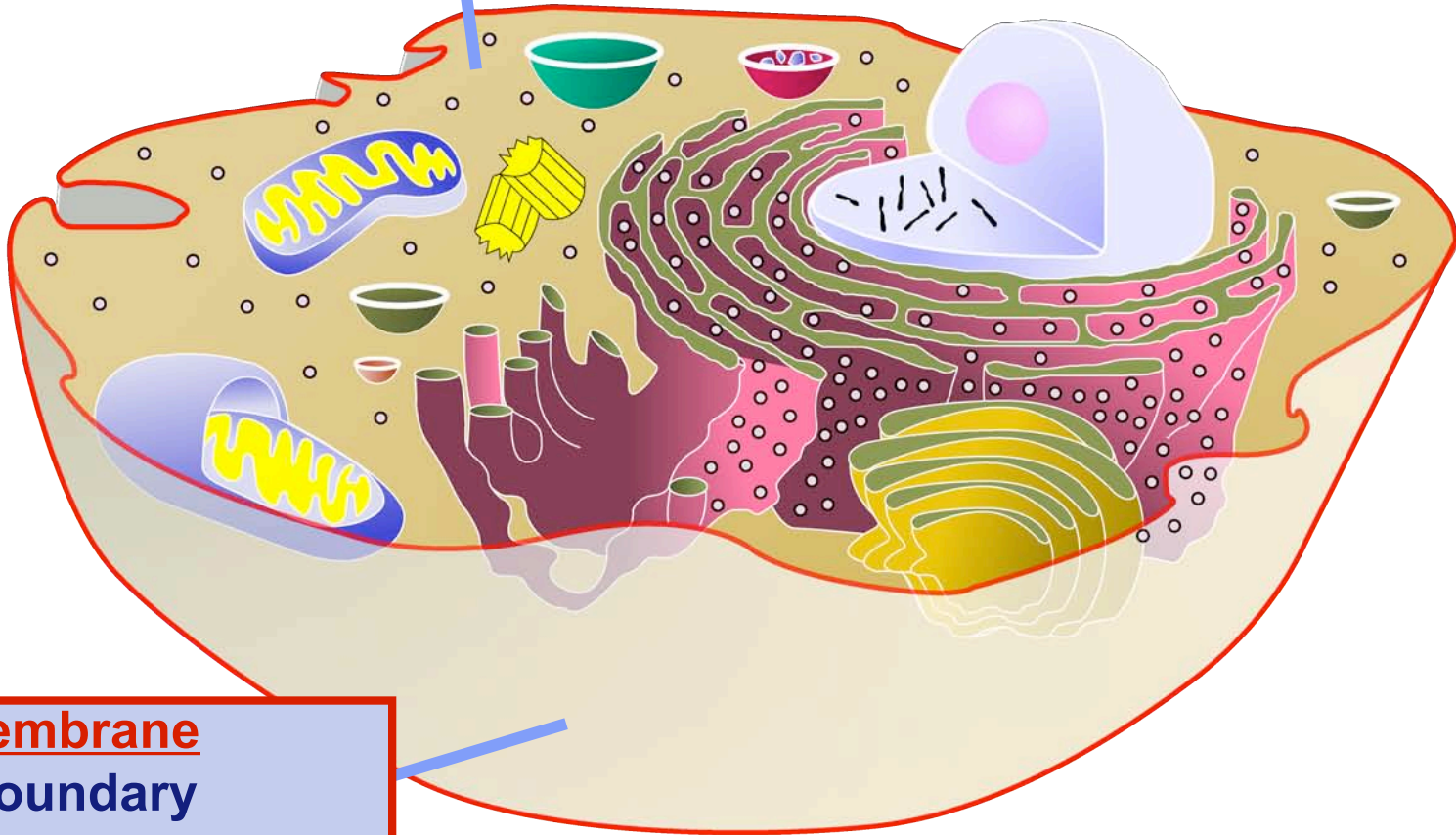
■ Structure

- ◆ double layer of fat
 - phospholipid bilayer
- ◆ receptor molecules
 - proteins



cytoplasm

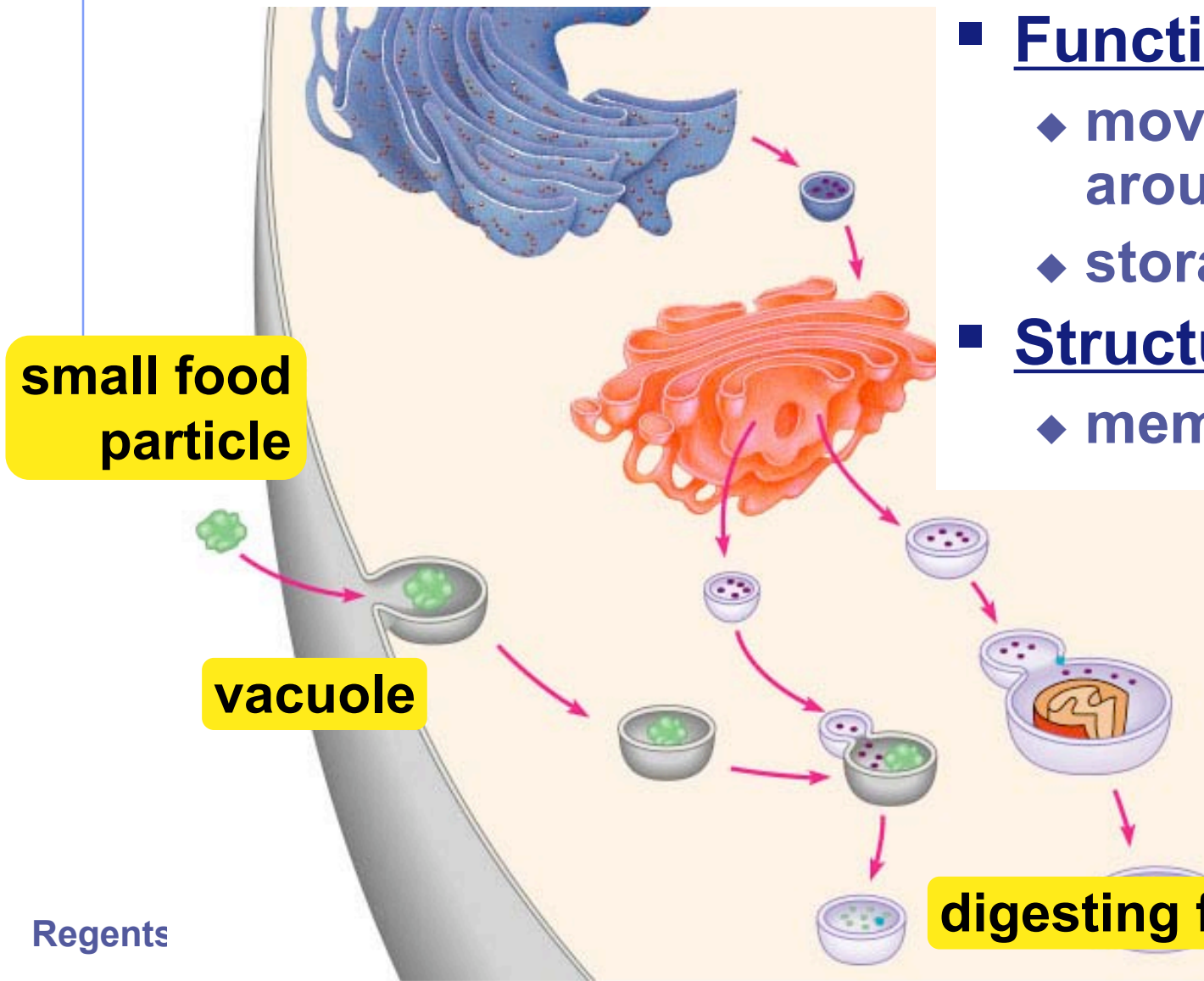
- jelly-like material holding organelles in place



cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals

Vacuoles & vesicles



■ Function

- ◆ moving material around cell
- ◆ storage

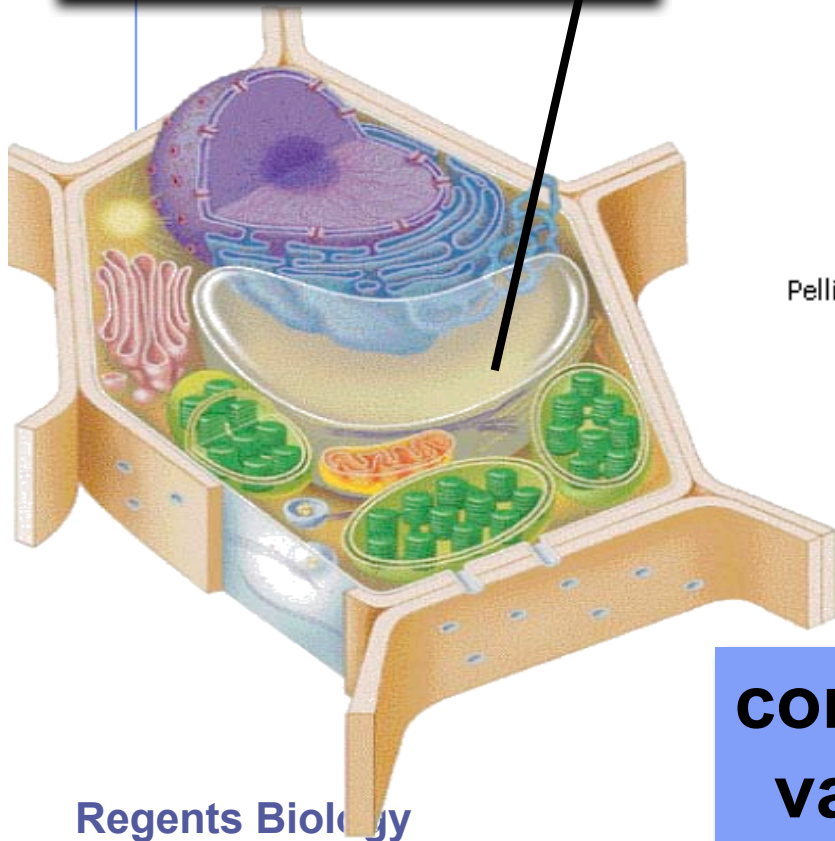
■ Structure

- ◆ membrane sac

Food & water storage

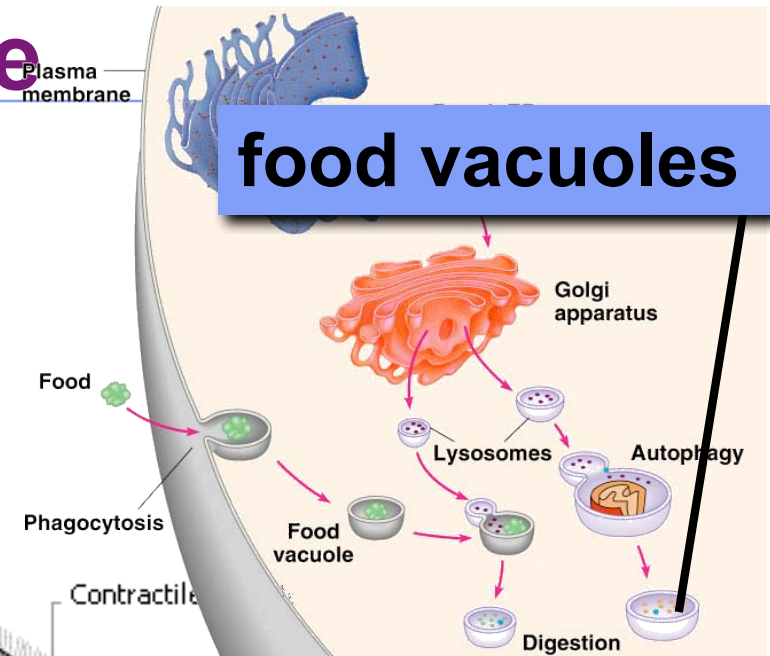
plant cells

central vacuole



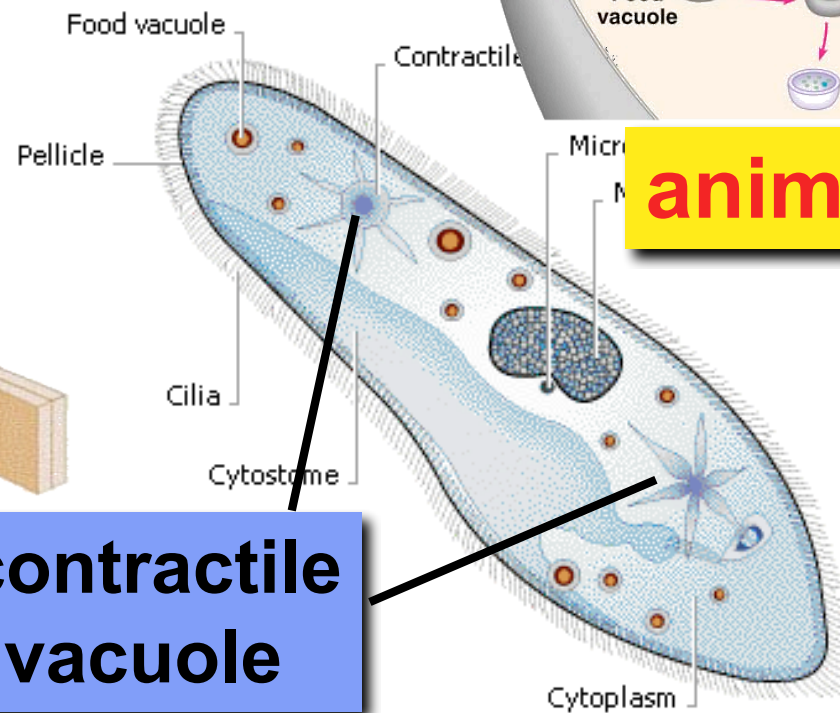
Regents Biology

food vacuoles



animal cells

contractile vacuole

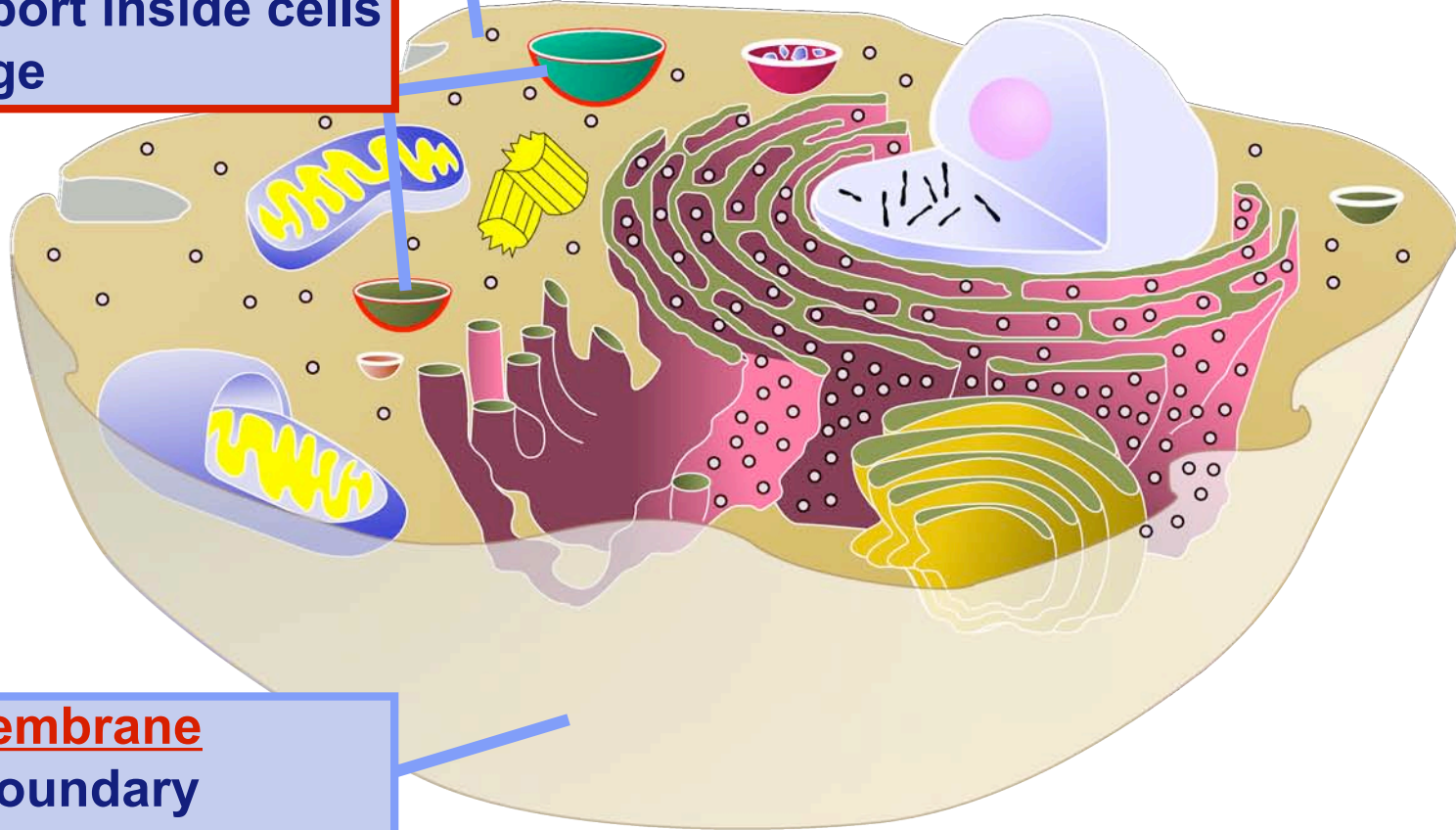


cytoplasm

- jelly-like material holding organelles in place

vacuole & vesicles

- transport inside cells
- storage



cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals

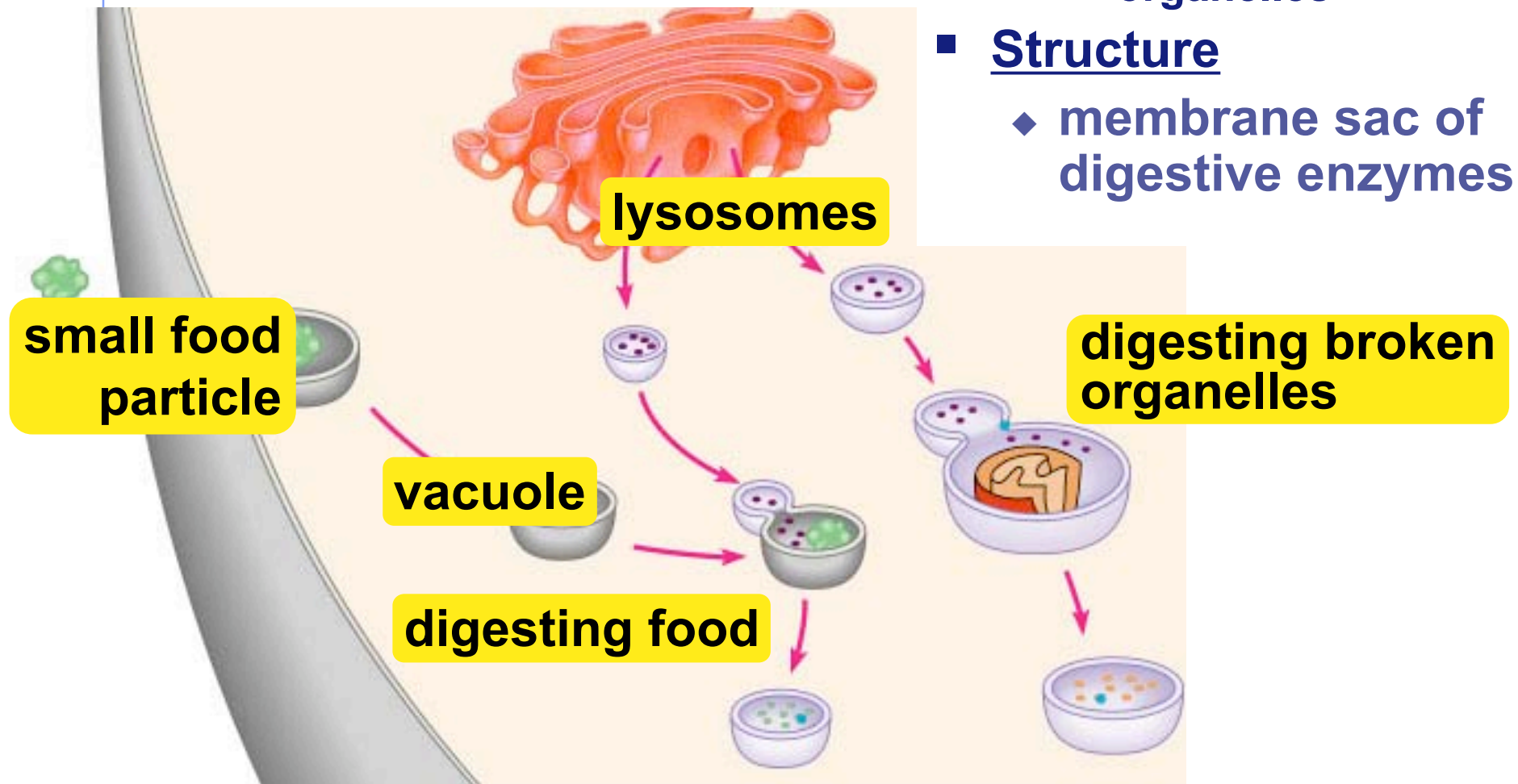
Lysosomes

■ Function

- ◆ digest food
- ◆ clean up & recycle
 - digest broken organelles

■ Structure

- ◆ membrane sac of digestive enzymes



cytoplasm

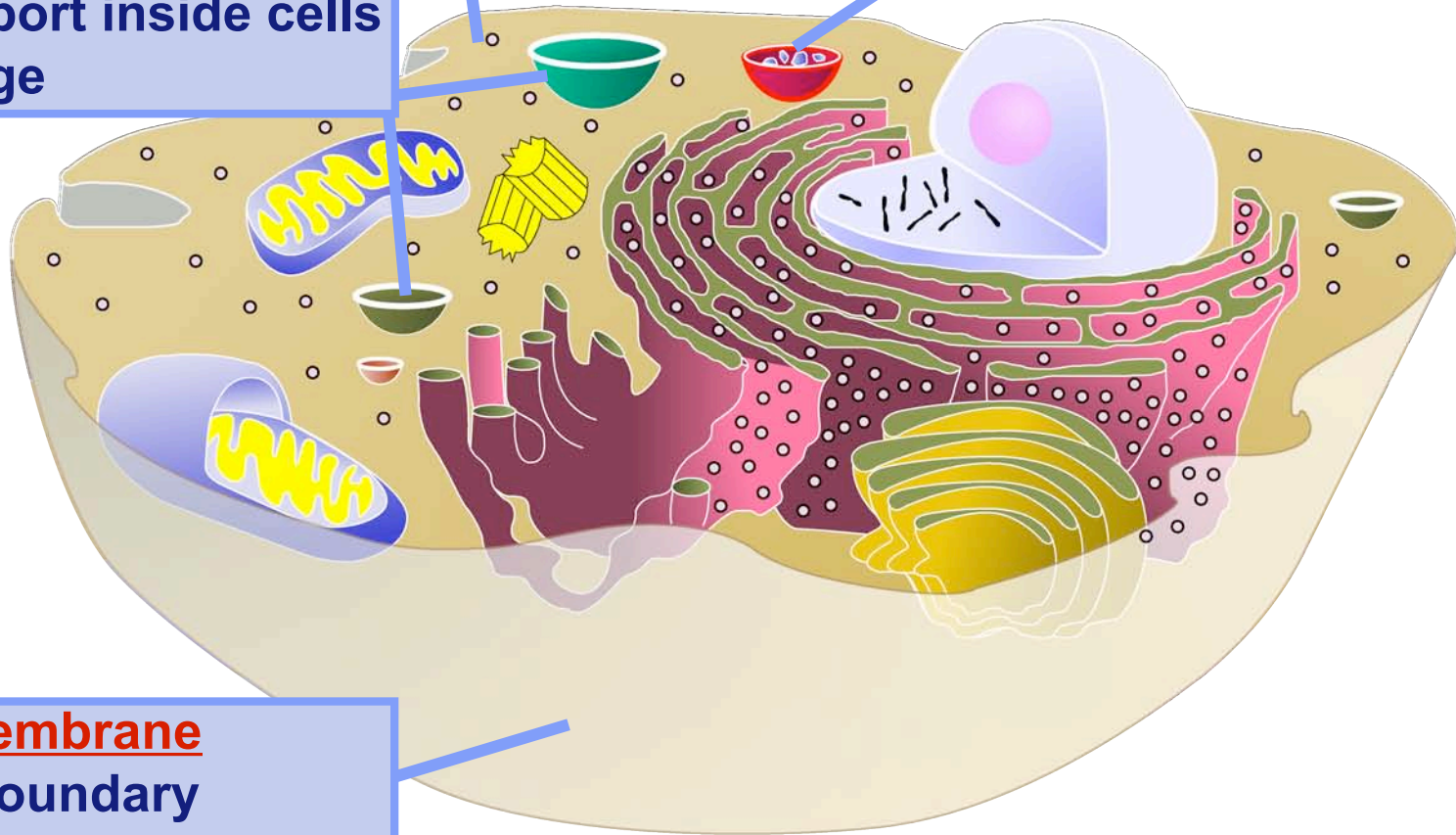
- jelly-like material holding organelles in place

vacuole & vesicles

- transport inside cells
- storage

lysosome

- food digestion
- garbage disposal & recycling



cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals

Mitochondria

■ Function

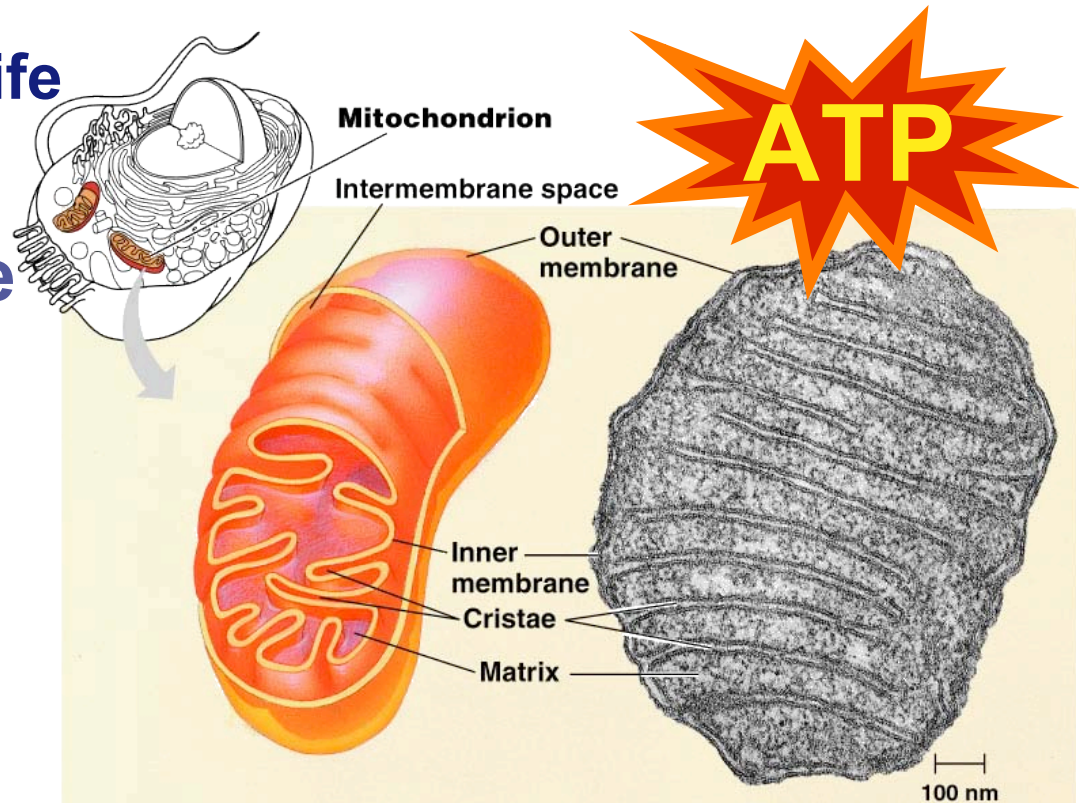
◆ make ATP energy from cellular respiration

- $\text{sugar} + \text{O}_2 \rightarrow \text{ATP}$
- fuels the work of life

■ Structure

◆ double membrane

in both animal & plant cells



cytoplasm

- jelly-like material holding organelles in place

vacuole & vesicles

- transport inside cells
- storage

lysosome

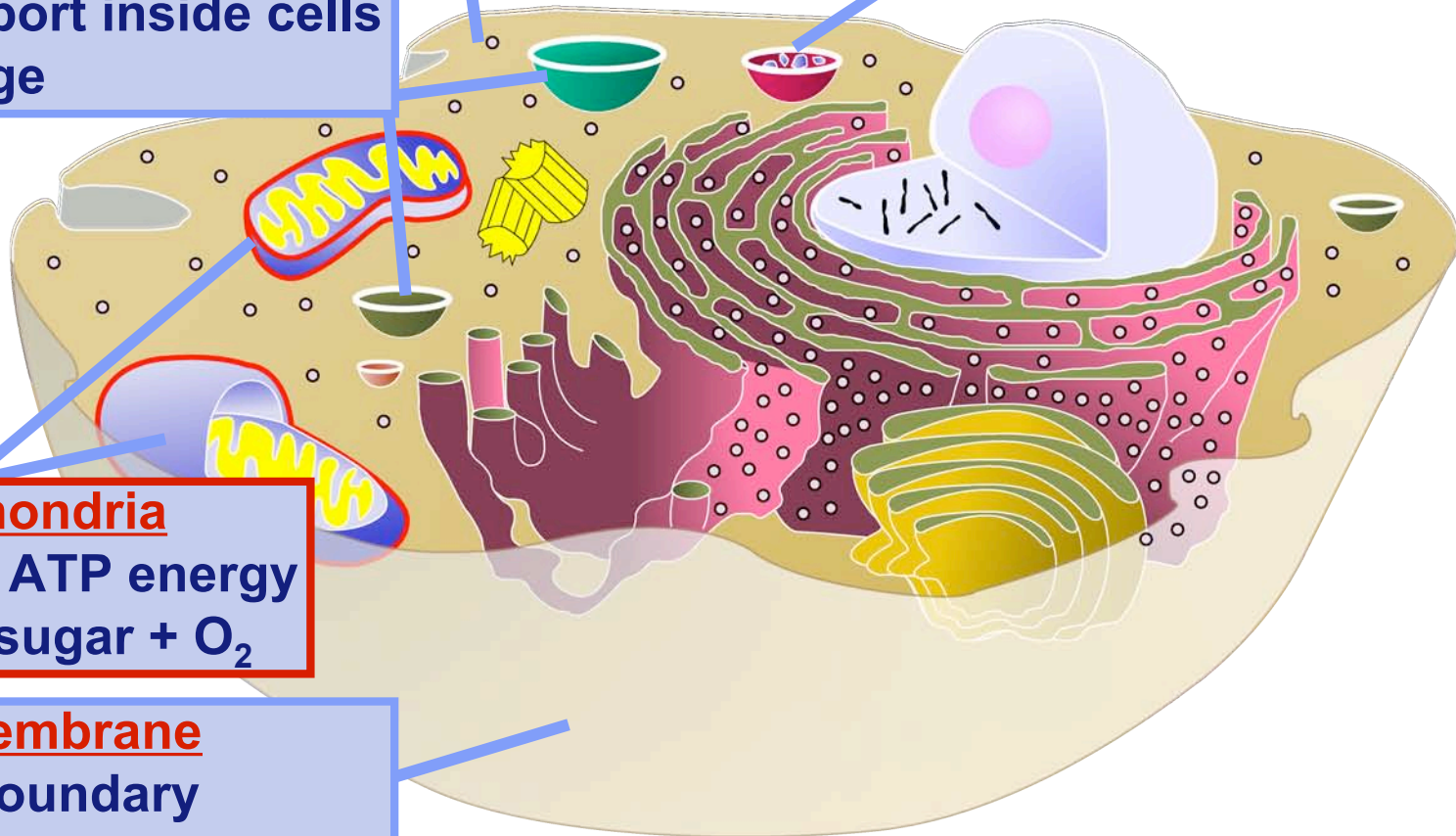
- food digestion
- garbage disposal & recycling

mitochondria

- make ATP energy from sugar + O₂

cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals



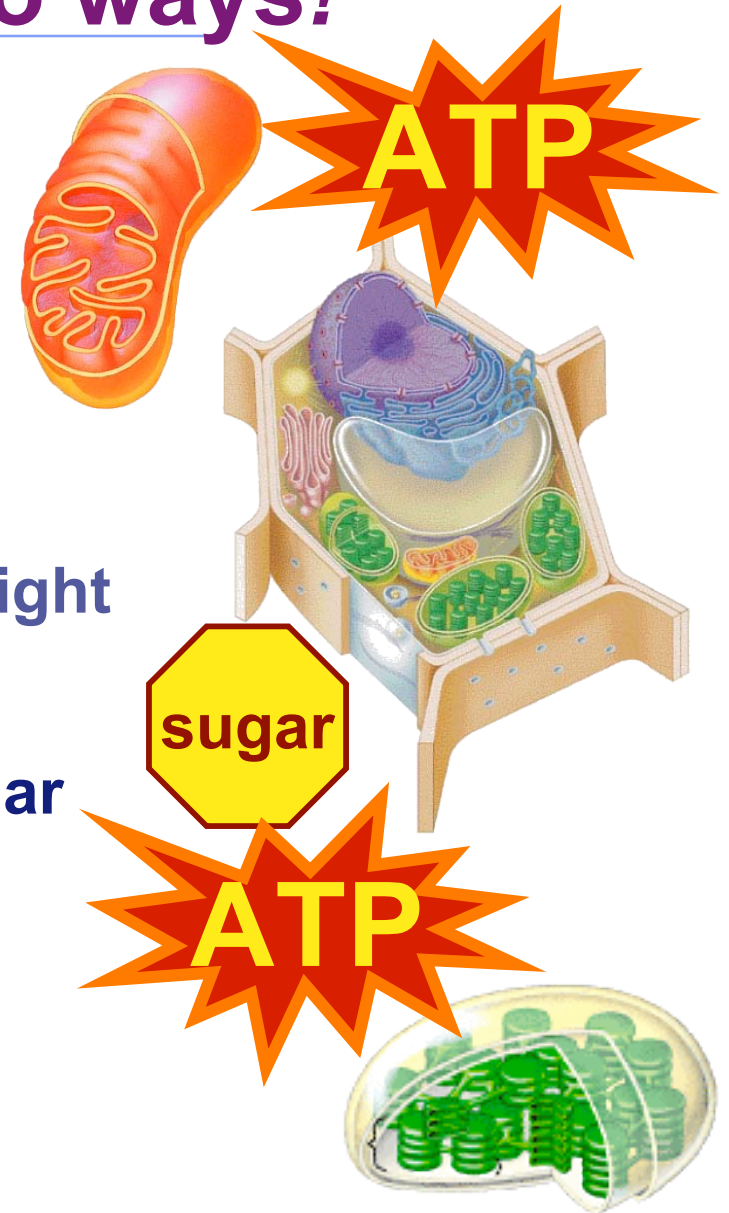
Plants make energy two ways!

■ Mitochondria

- ◆ make energy from sugar + O₂
 - cellular respiration
 - $\text{sugar} + \text{O}_2 \rightarrow \text{ATP}$

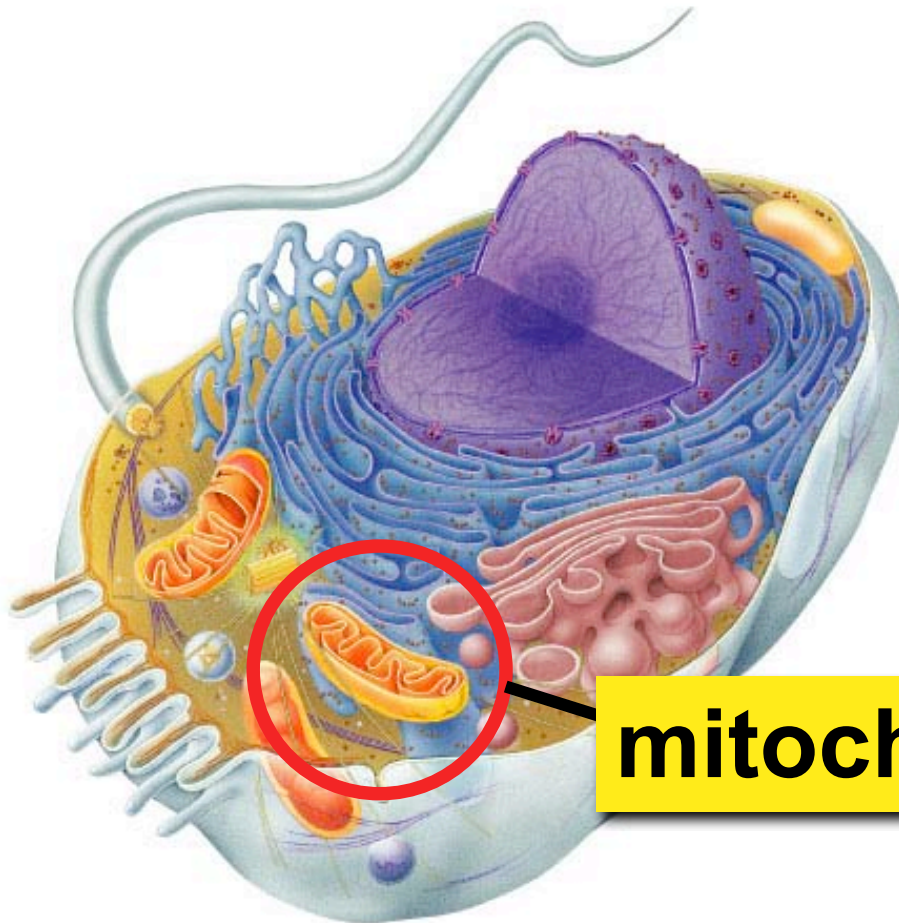
■ Chloroplasts

- ◆ make energy + sugar from sunlight
 - photosynthesis
 - $\text{sunlight} + \text{CO}_2 \rightarrow \text{ATP} \text{ \& \; } \text{sugar}$
 - ◆ ATP = active energy
 - ◆ sugar = stored energy
 - build leaves & roots & fruit out of the sugars



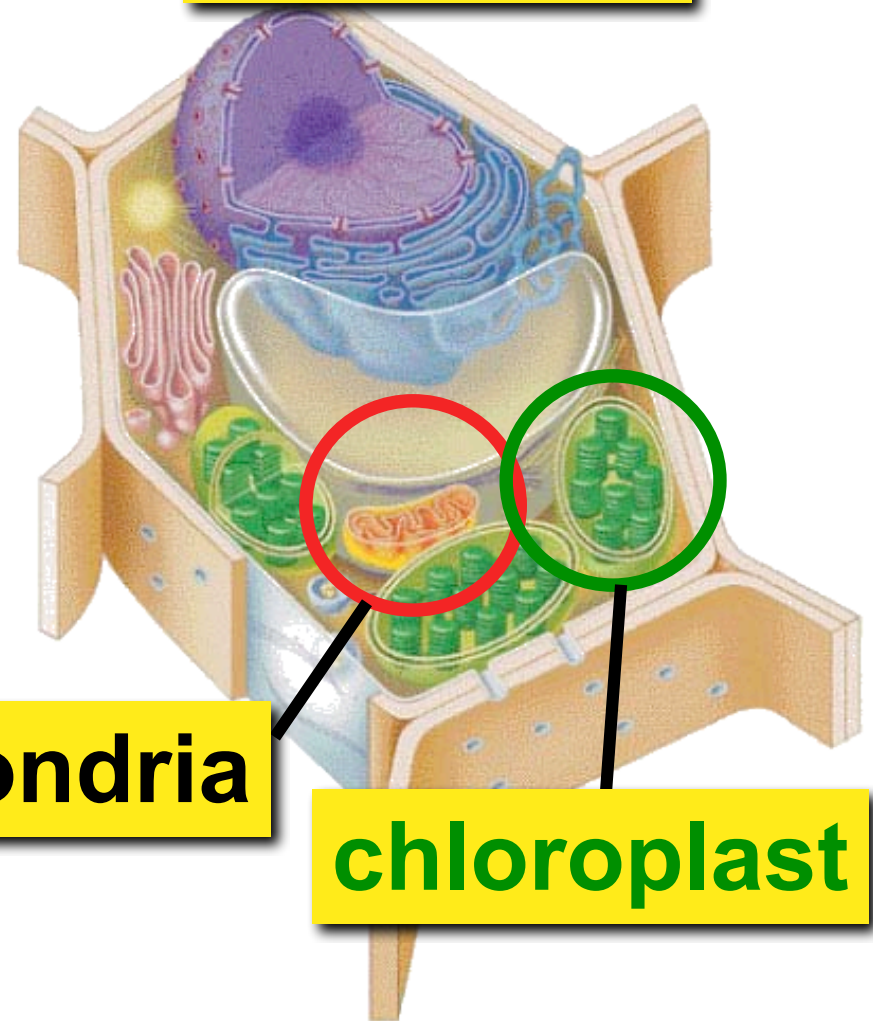
Mitochondria are in both cells!!

animal cells

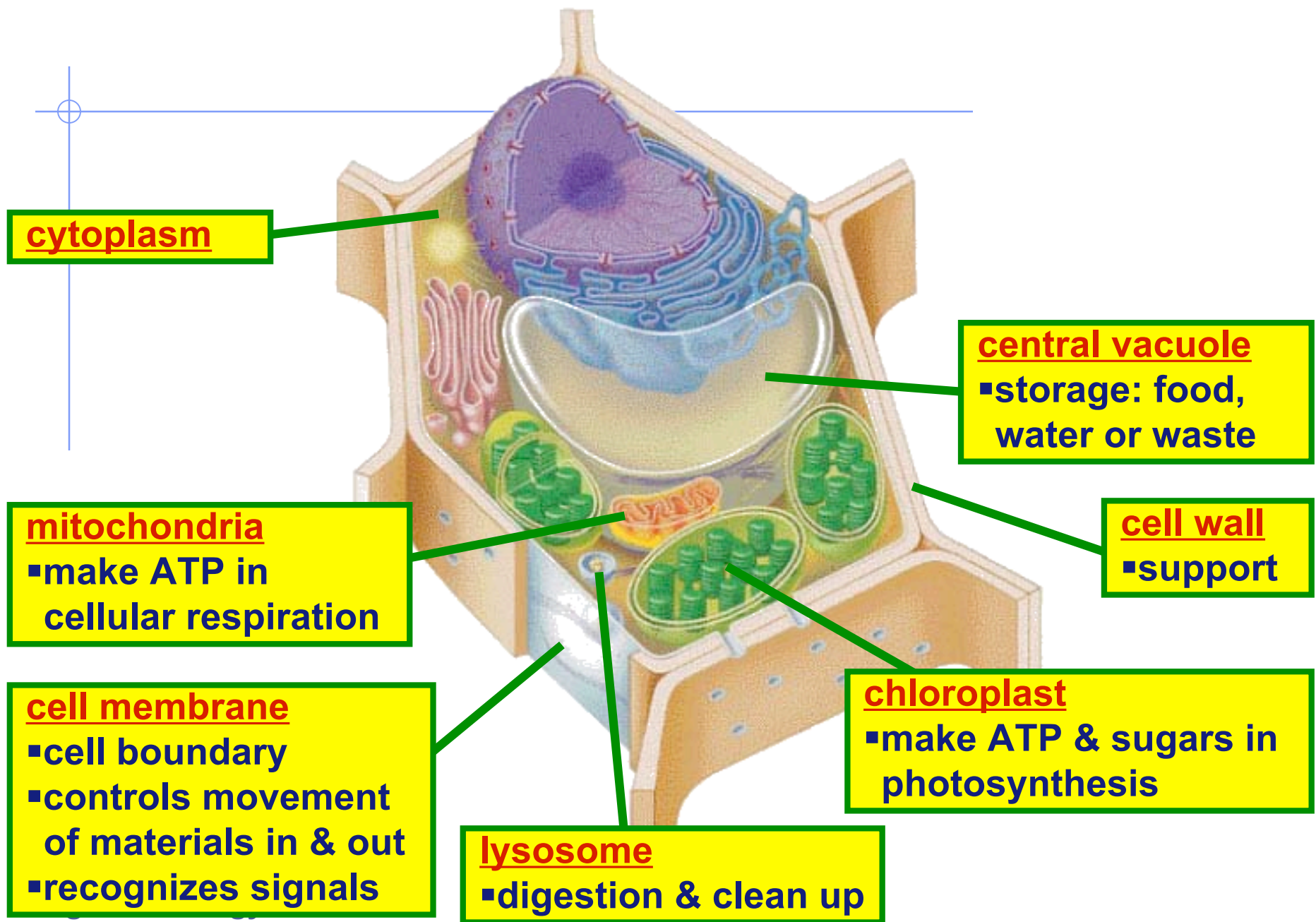


mitochondria

plant cells



chloroplast



Cells need workers (proteins)!

■ Making proteins

◆ to run daily life & growth, the cell must...

- read genes (DNA)
- build proteins
 - ◆ structural proteins (muscle fibers, hair, skin, claws)
 - ◆ enzymes (speed up chemical reactions)
 - ◆ signals (hormones) & receptors

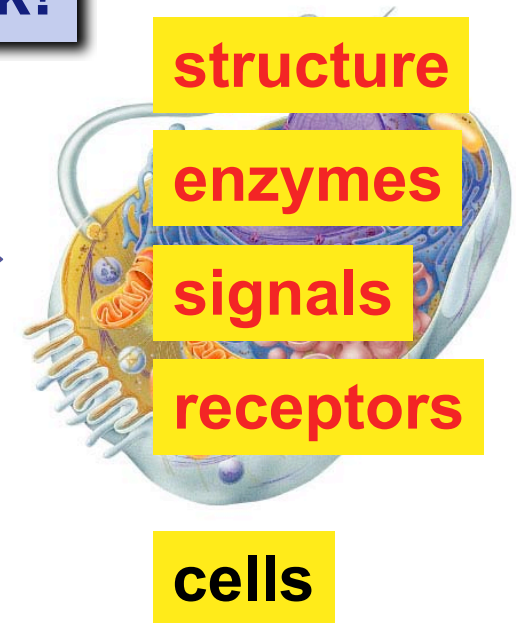
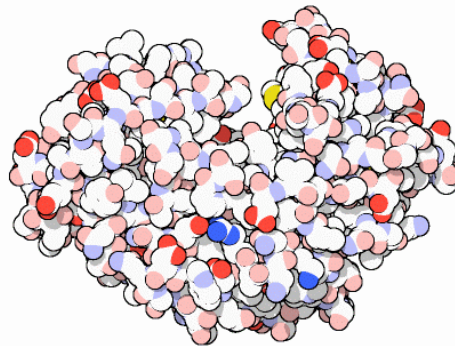
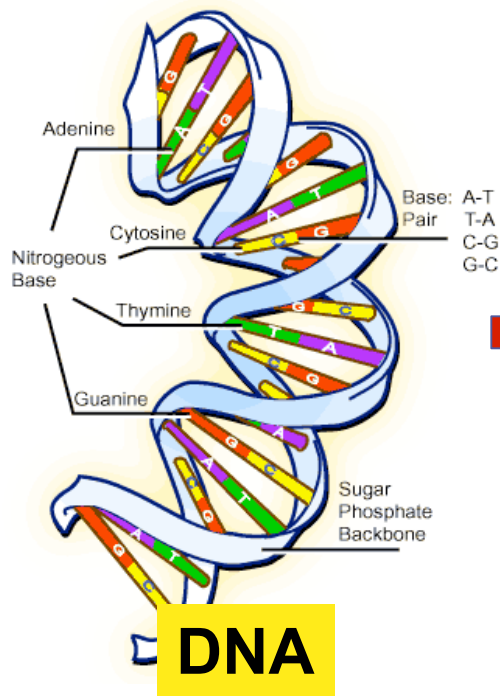
◆ organelles that do this work...

- nucleus
- ribosomes
- endoplasmic reticulum (ER)
- Golgi apparatus

Proteins do all the work!

one of the major job of cells is to make proteins,
because...

proteins do all the work!



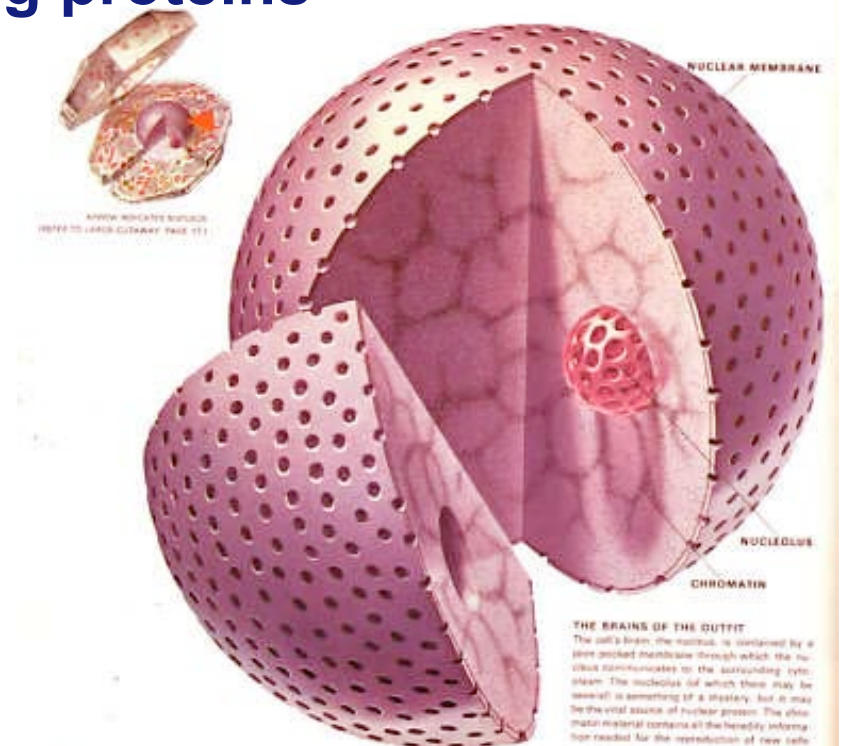
Nucleus

■ Function

- ◆ control center of cell
- ◆ protects DNA
 - instructions for building proteins

■ Structure

- ◆ nuclear membrane
- ◆ nucleolus
 - ribosome factory
- ◆ chromosomes
 - DNA



cytoplasm

- jelly-like material holding organelles in place

lysosome

- food digestion
- garbage disposal & recycling

vacuole & vesicles

- transport inside cells
- storage

nucleus

- protects DNA
- controls cell

chromosomes

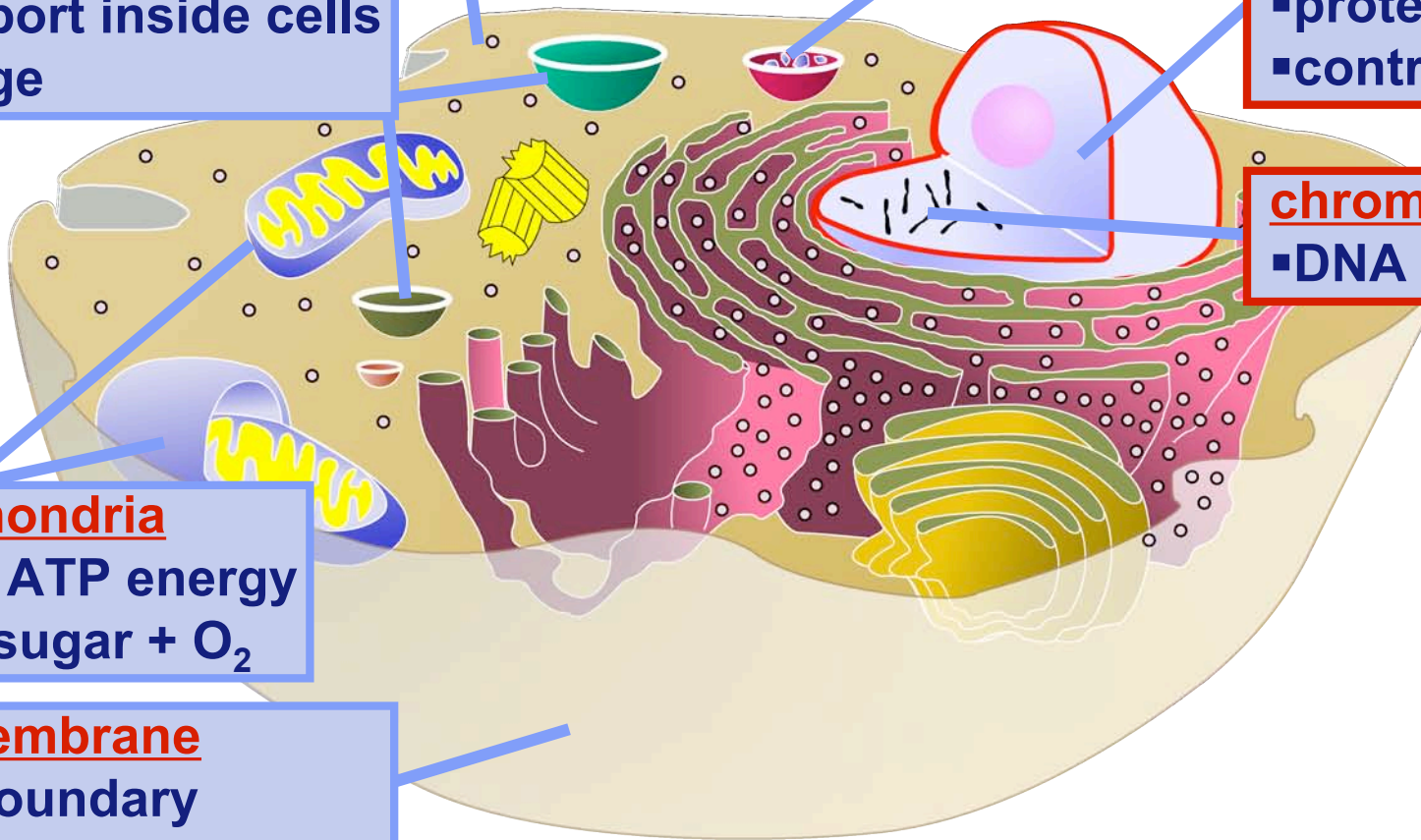
- DNA

mitochondria

- make ATP energy from sugar + O₂

cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals



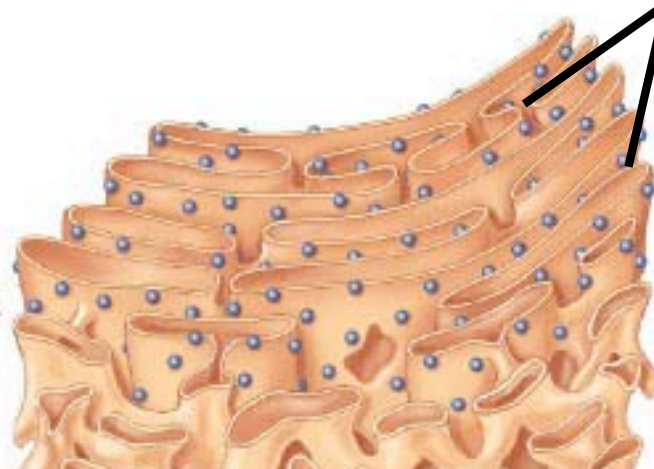
Ribosomes

■ Function

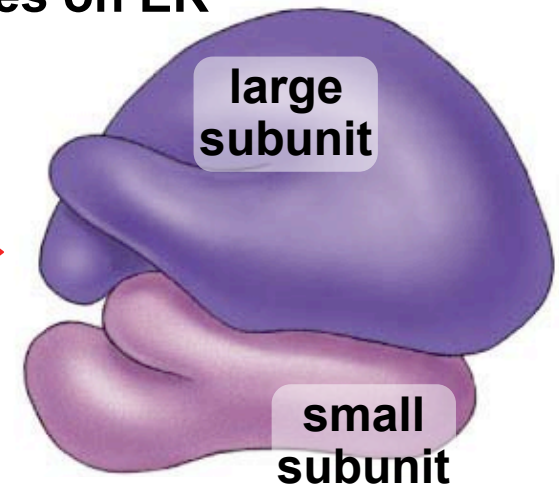
- ◆ protein factories
- ◆ read instructions to build proteins from DNA

■ Structure

- ◆ 2 subunits
- ◆ some free in cytoplasm
- ◆ some attached to ER



Ribosomes on ER



cytoplasm

- jelly-like material holding organelles in place

lysosome

- food digestion
- garbage disposal & recycling

vacuole & vesicles

- transport inside cells
- storage

nucleus

- protects DNA
- controls cell

mitochondria

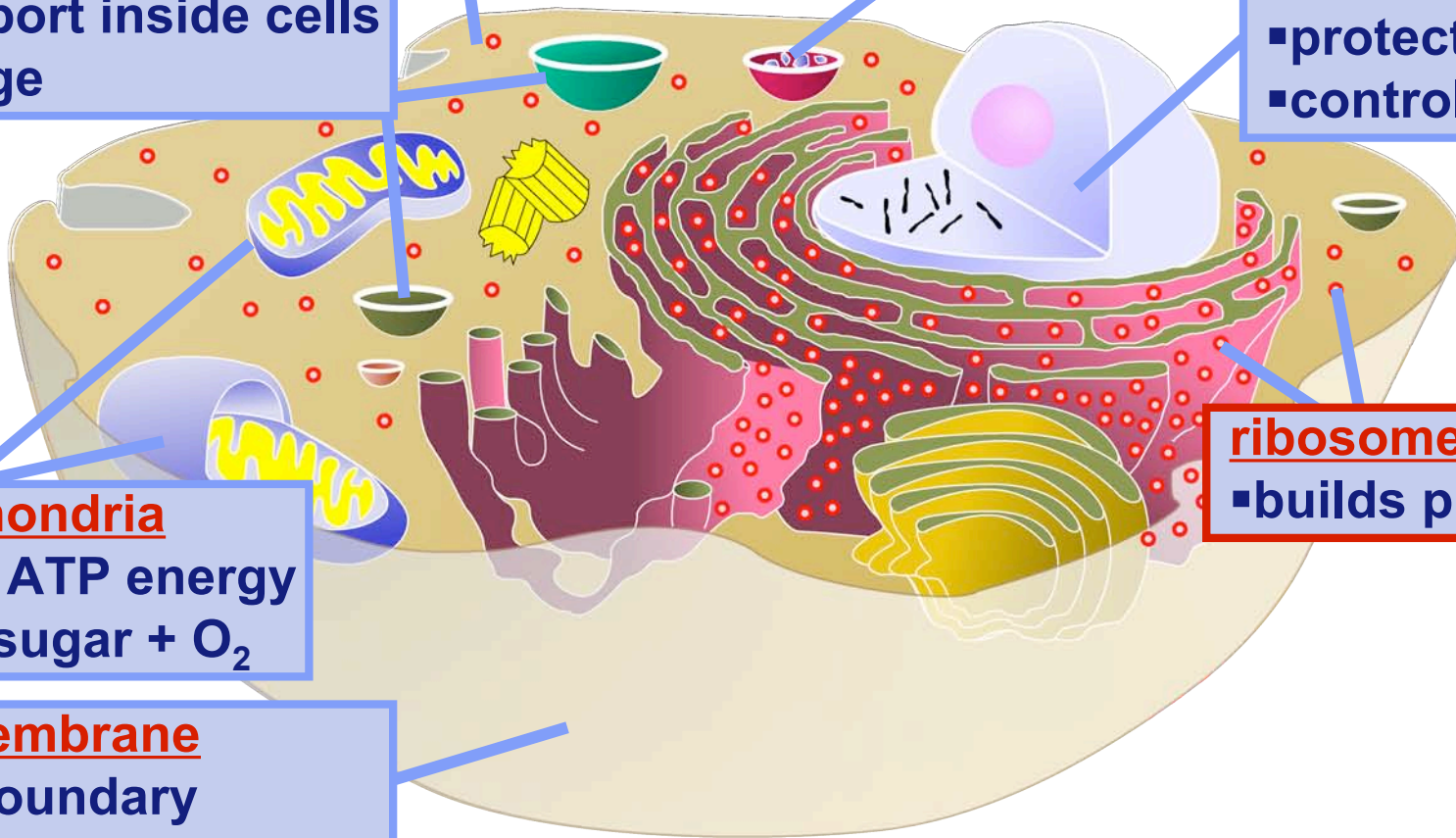
- make ATP energy from sugar + O₂

ribosomes

- builds proteins

cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals



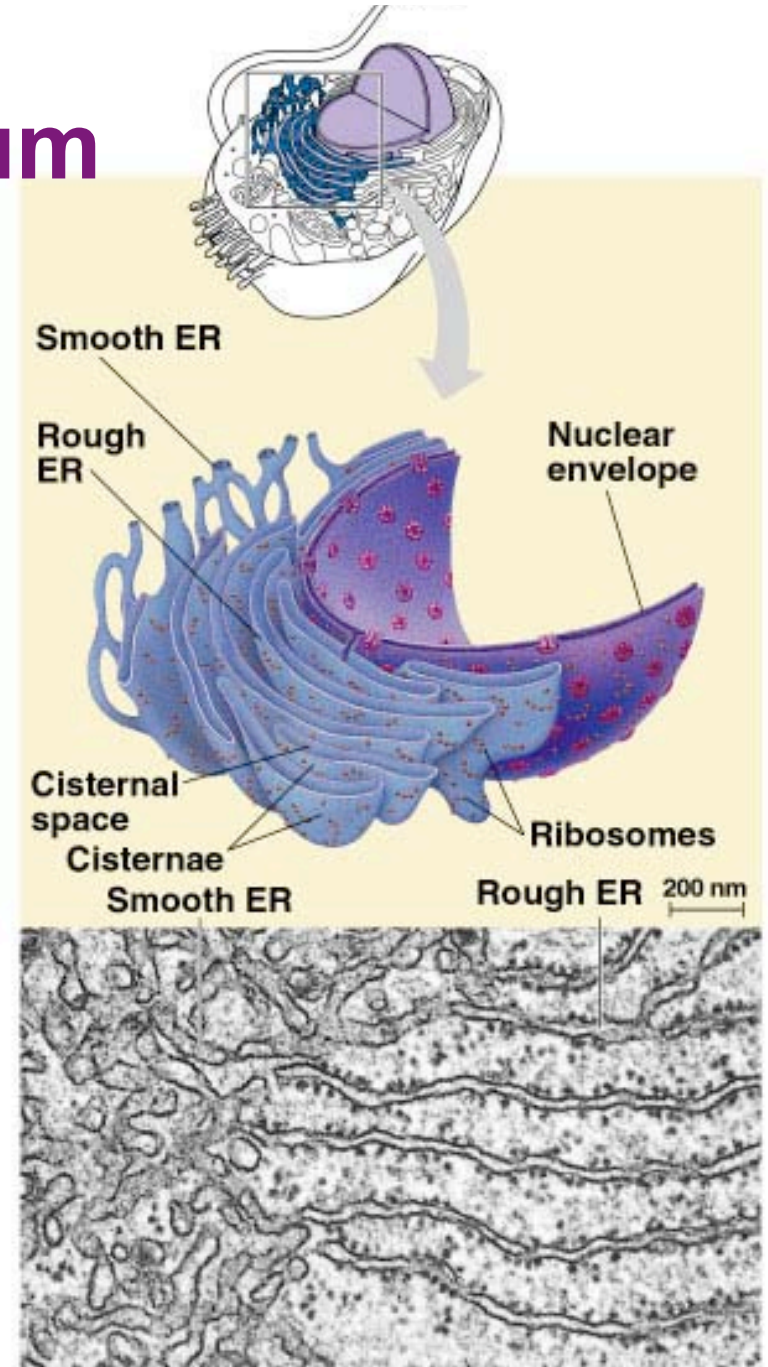
Endoplasmic Reticulum

■ Function

- ◆ part of protein factory
 - helps complete the proteins
- ◆ makes membranes

■ Structure

- ◆ rough ER
 - ribosomes attached
 - works on proteins
- ◆ smooth ER
 - makes membranes



cytoplasm

- jelly-like material holding organelles in place

vacuole & vesicles

- transport inside cells
- storage

lysosome

- food digestion
- garbage disposal & recycling

nucleus

- protects DNA
- controls cell

mitochondria

- make ATP energy from sugar + O₂

cell membrane

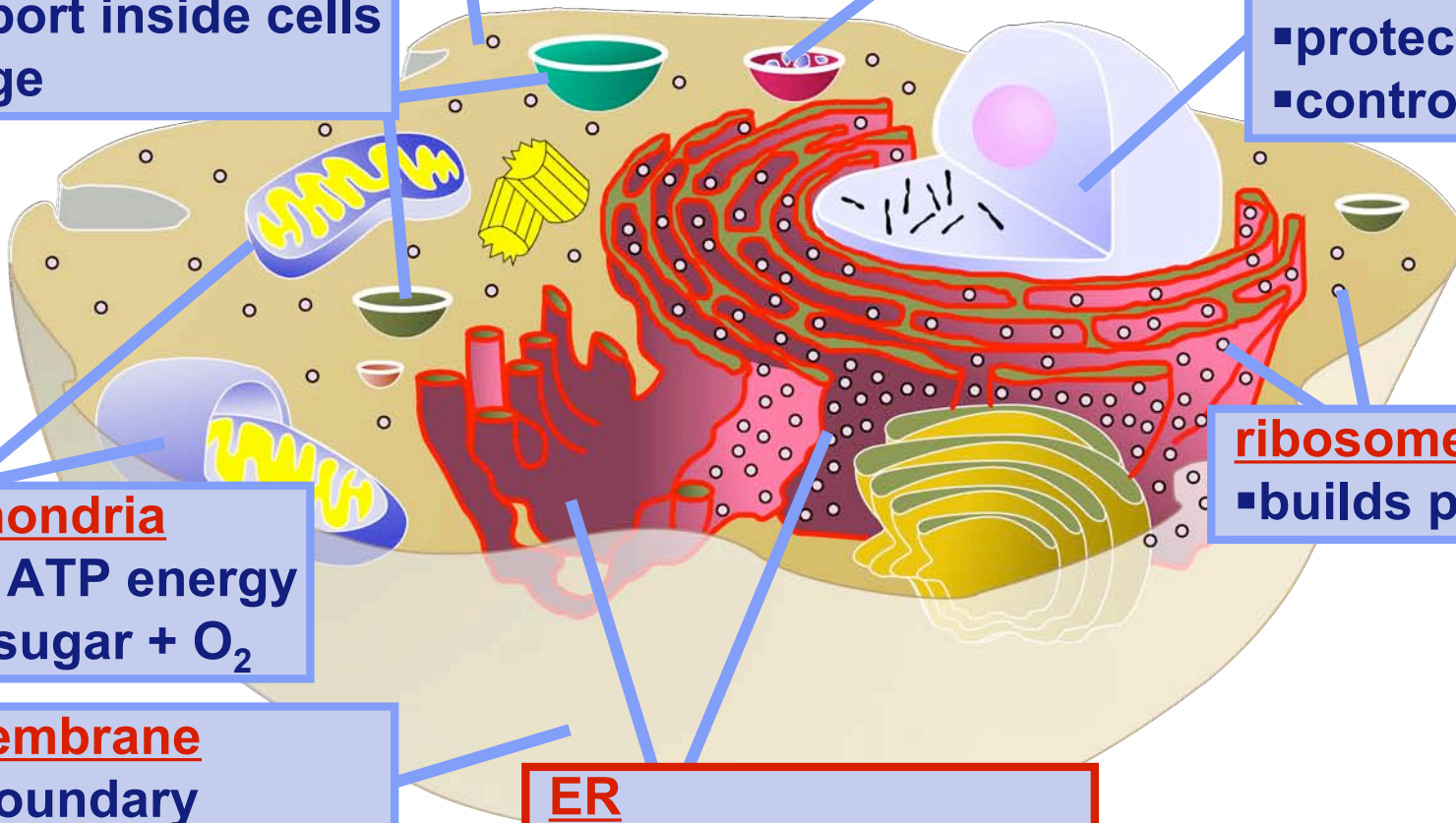
- cell boundary
- controls movement of materials in & out
- recognizes signals

ER

- helps finish proteins
- makes membranes

ribosomes

- builds proteins



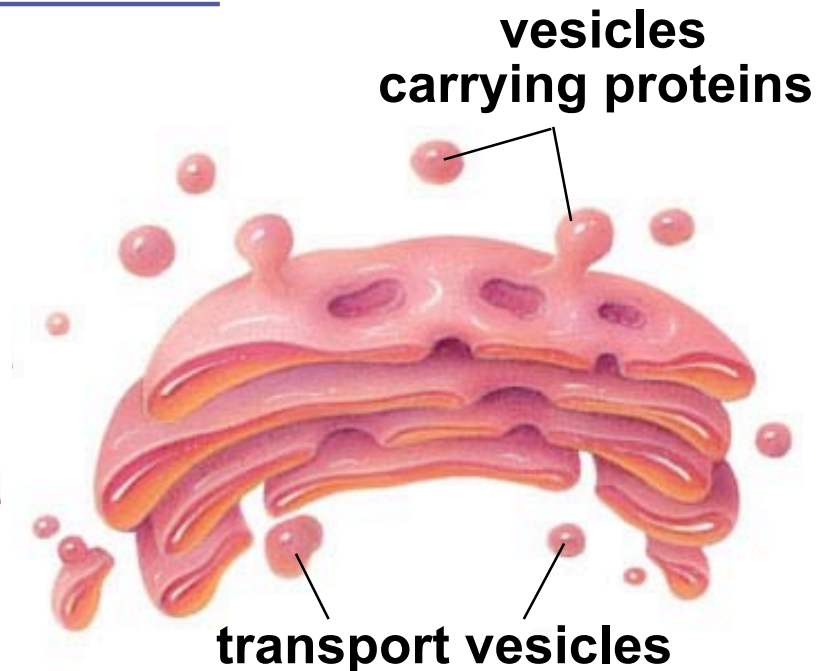
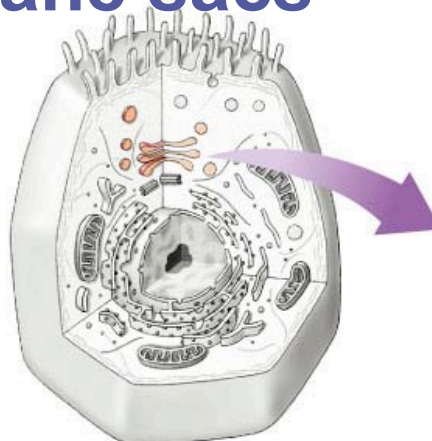
Golgi Apparatus

■ Function

- ◆ finishes, sorts, labels & ships proteins
 - like UPS headquarters
 - ◆ shipping & receiving department
- ◆ ships proteins in vesicles
 - “UPS trucks”

■ Structure

- ◆ membrane sacs



cytoplasm

- jelly-like material holding organelles in place

vacuole & vesicles

- transport inside cells
- storage

lysosome

- food digestion
- garbage disposal & recycling

nucleus

- protects DNA
- controls cell

mitochondria

- make ATP energy from sugar + O₂

cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals

ER

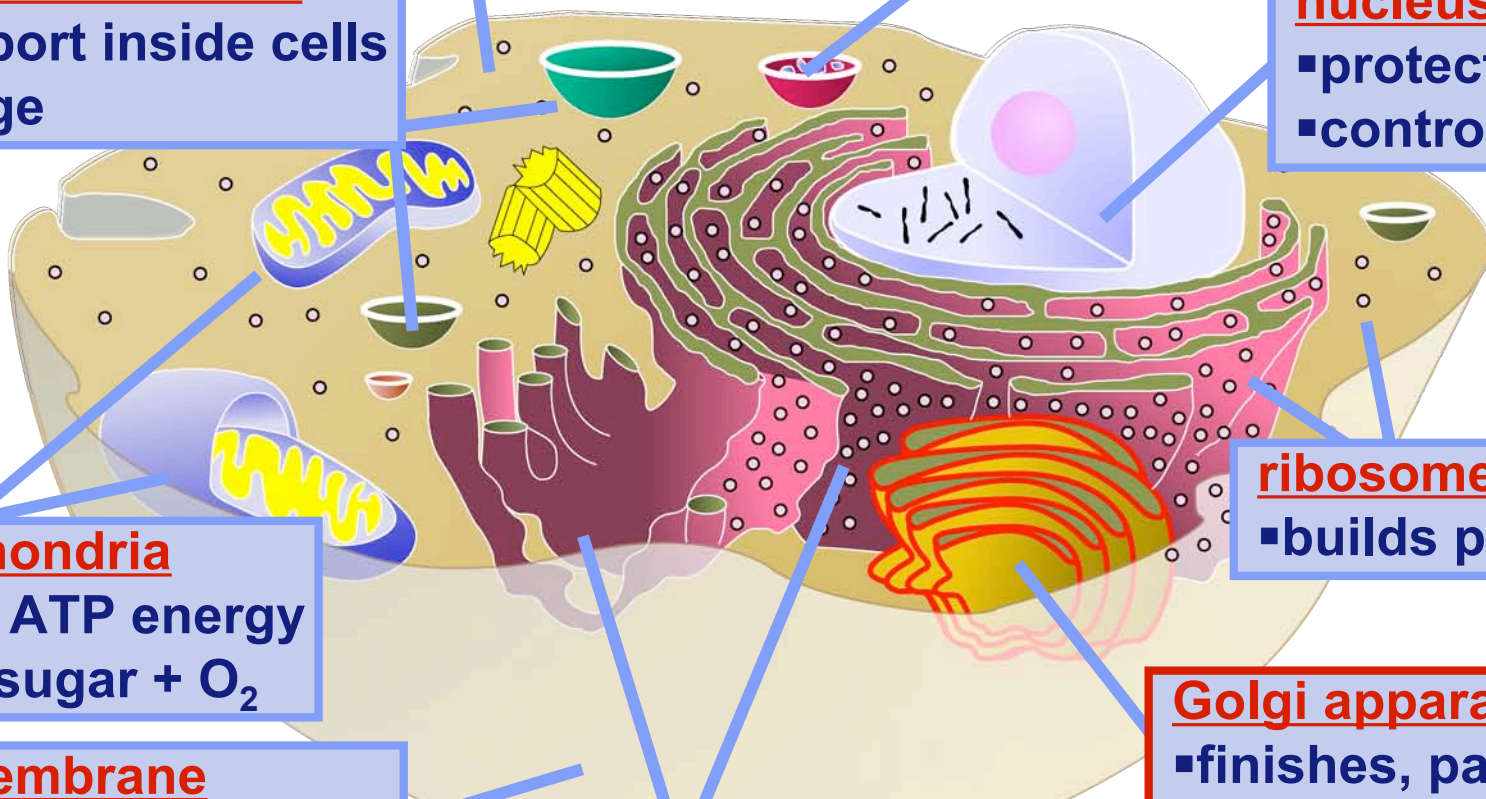
- helps finish proteins
- makes membranes

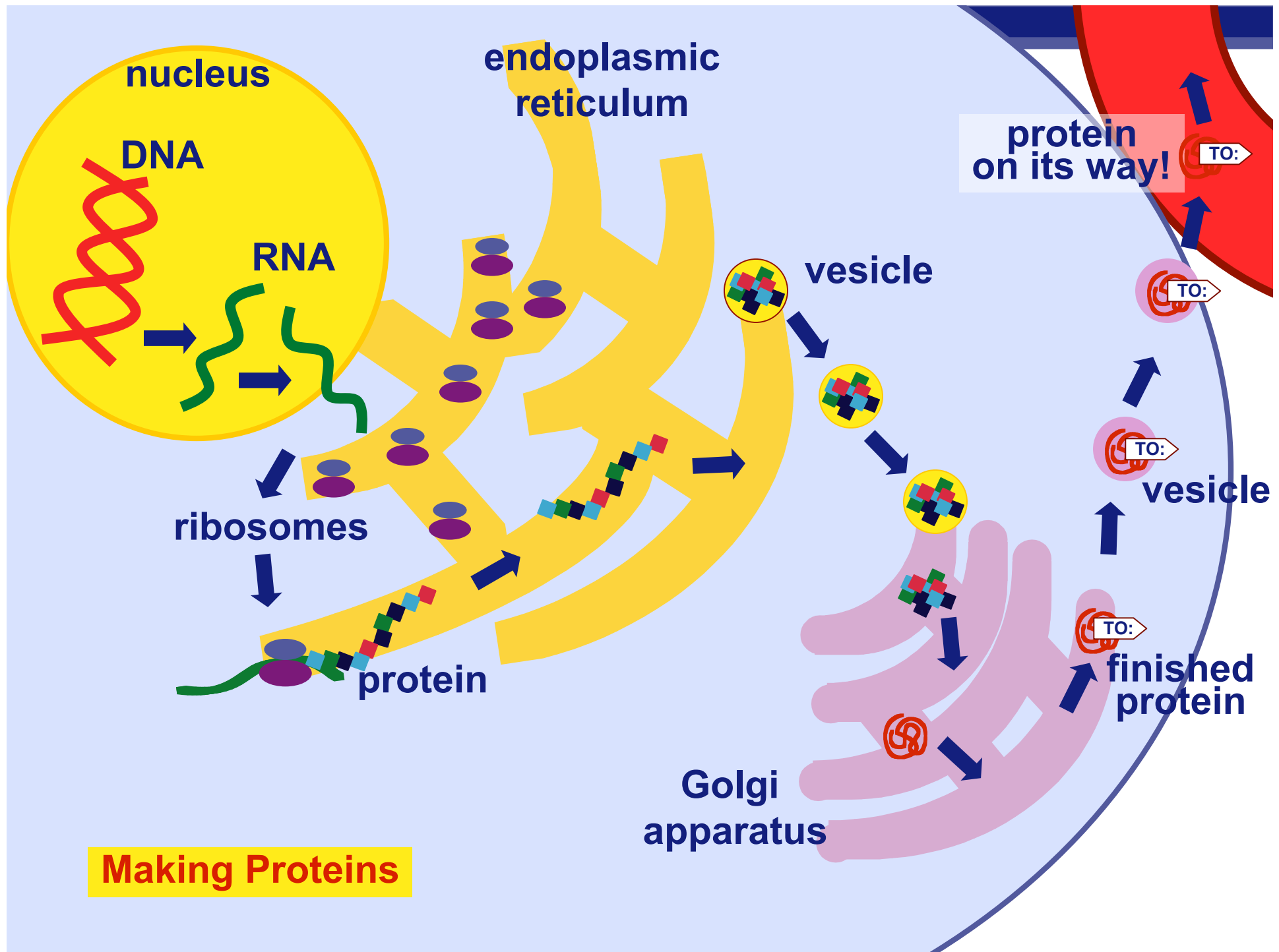
ribosomes

- builds proteins

Golgi apparatus

- finishes, packages & ships proteins





Making Proteins

nucleus
▪control cell
▪protects DNA

cytoplasm

Golgi apparatus
▪finish & ship proteins

mitochondria
▪make ATP in cellular respiration

cell membrane
▪cell boundary
▪controls movement of materials in & out
▪recognizes signals

lysosome
▪digestion & clean up

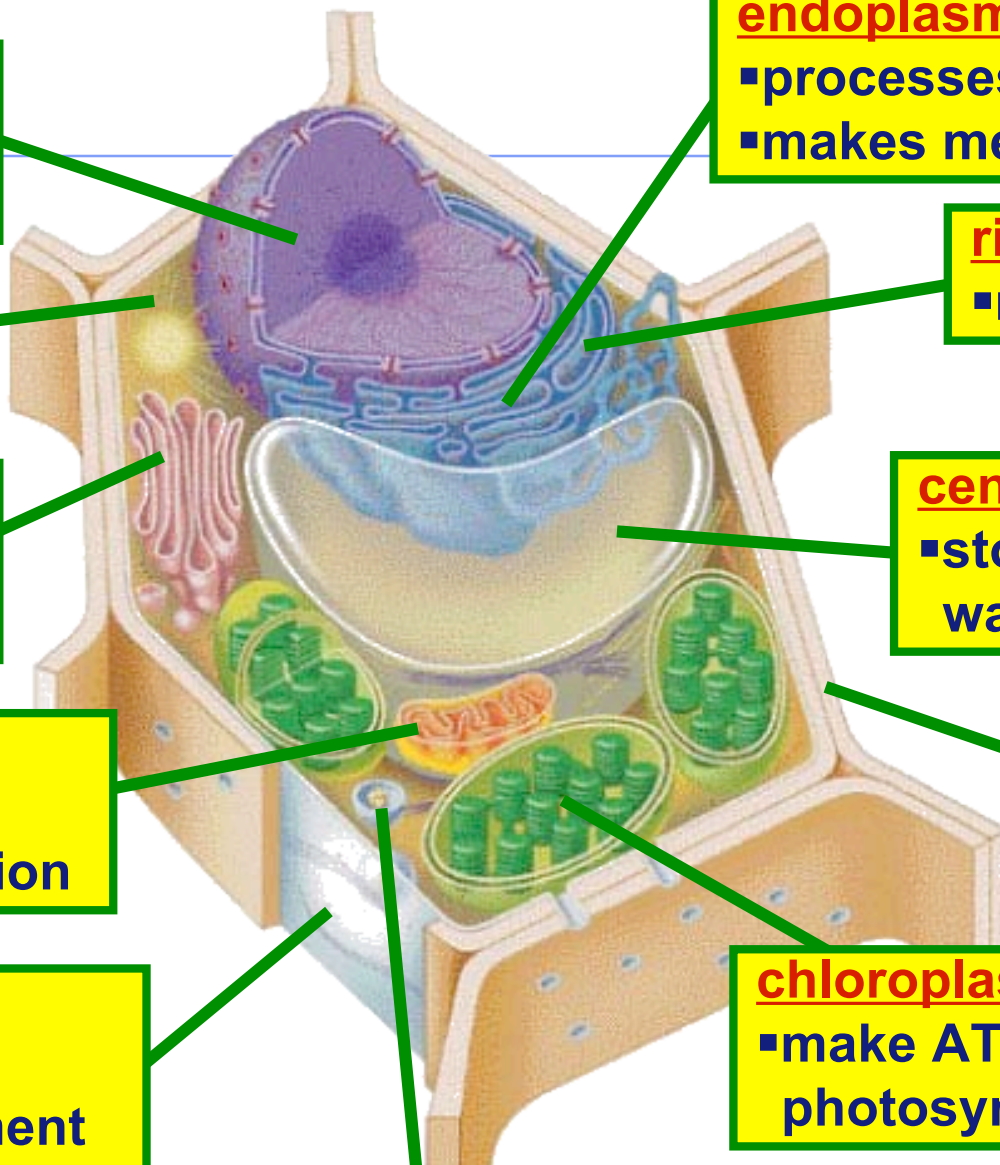
endoplasmic reticulum
▪processes proteins
▪makes membranes

ribosomes
▪make proteins

central vacuole
▪storage: food, water or waste

cell wall
▪support

chloroplast
▪make ATP & sugars in photosynthesis



Cells need to make more cells!

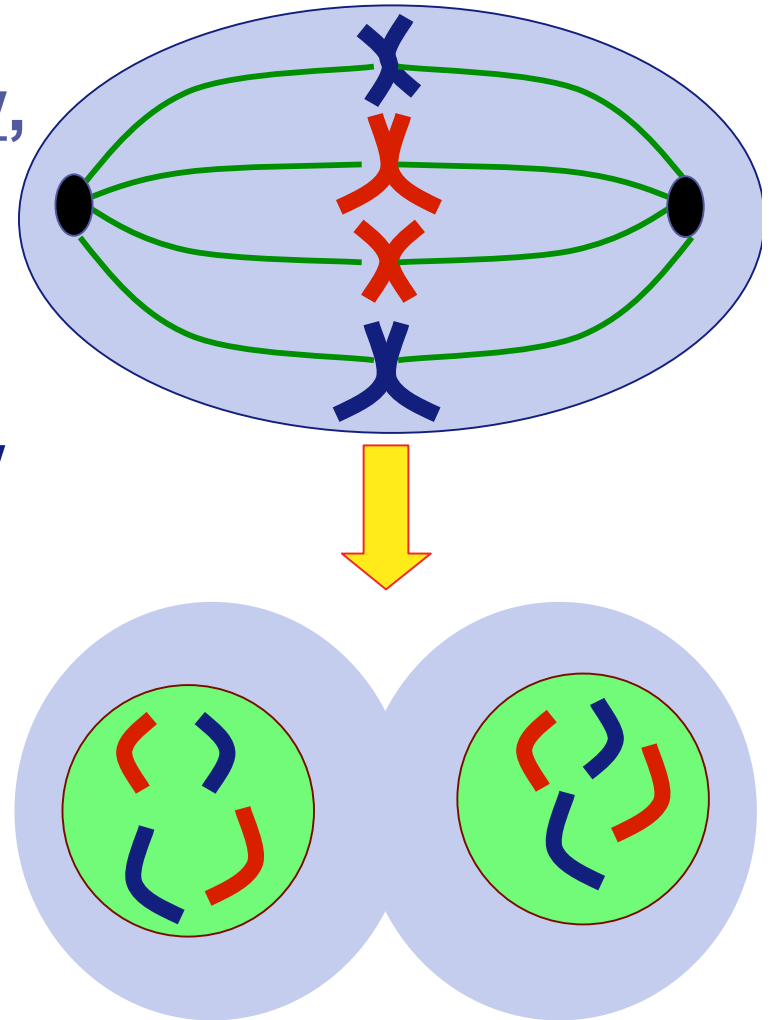
■ Making more cells

◆ to replace, repair & grow, the cell must...

- copy their DNA
- make extra organelles
- divide the new DNA & new organelles between 2 new “daughter” cells

◆ organelles that do this work...

- nucleus
- centrioles



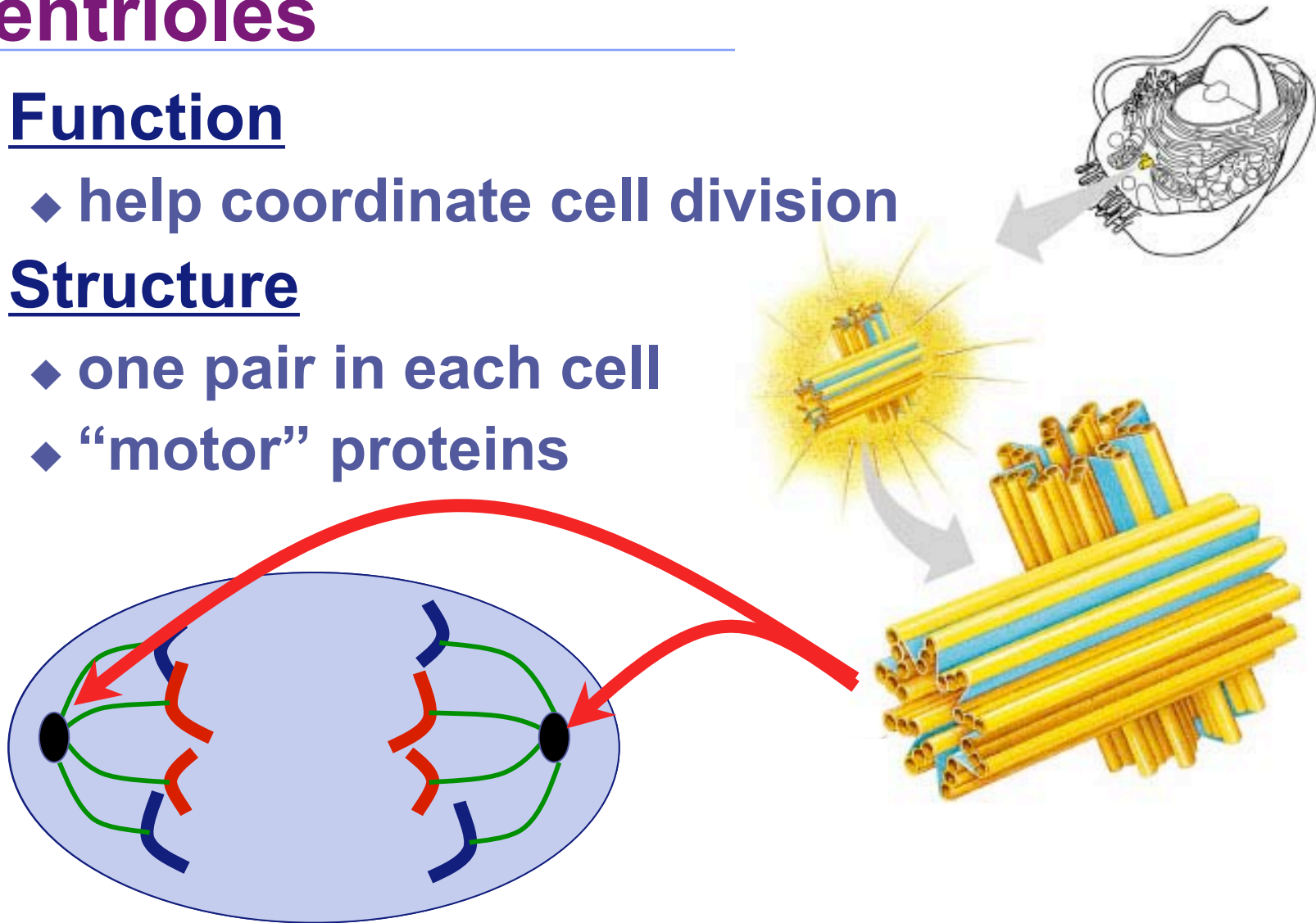
Centrioles

■ Function

- ◆ help coordinate cell division

■ Structure

- ◆ one pair in each cell
- ◆ “motor” proteins



cytoplasm

- jelly-like material holding organelles in place

vacuole & vesicles

- transport inside cells
- storage

centrioles

- cell division

mitochondria

- make ATP energy from sugar + O₂

cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals

lysosome

- food digestion
- garbage disposal & recycling

nucleus

- protects DNA
- controls cell

ribosomes

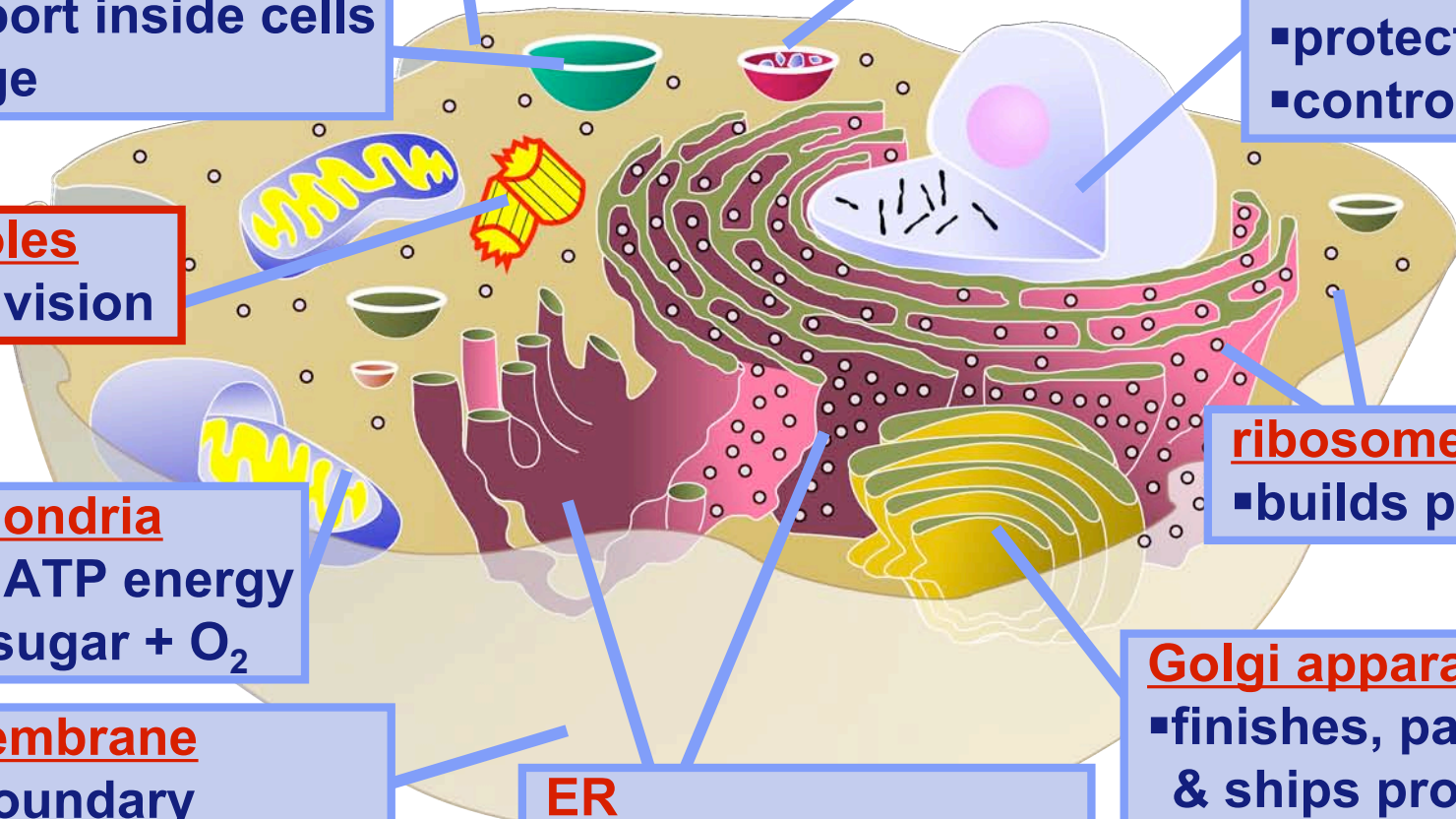
- builds proteins

Golgi apparatus

- finishes, packages & ships proteins

ER

- helps finish proteins
- makes membranes



Cell Summary

- Cells have 3 main jobs

- ◆ make energy

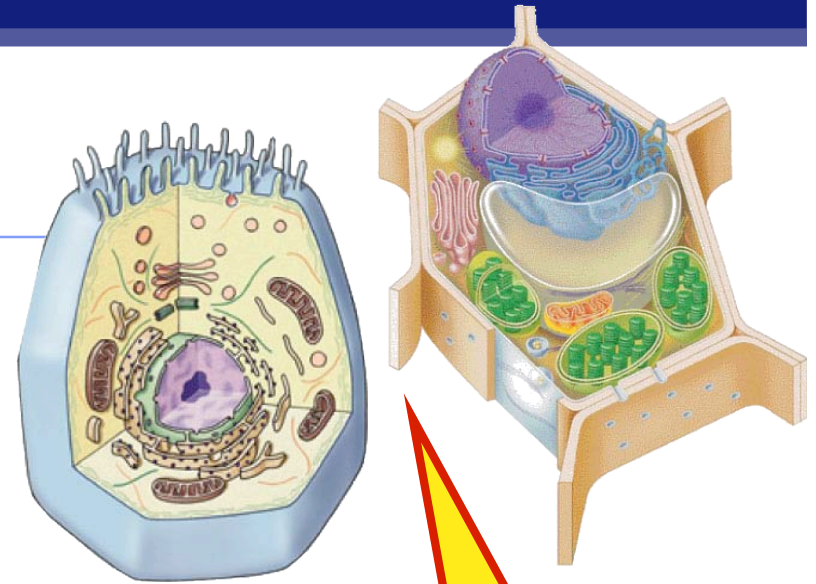
- need food + O₂
- cellular respiration & photosynthesis
- need to remove wastes

- ◆ make proteins

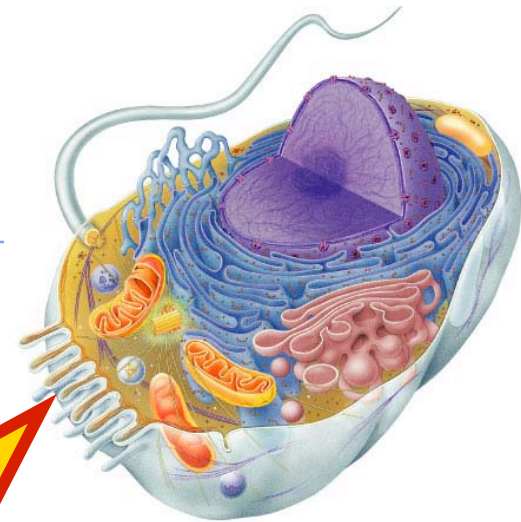
- need instructions from DNA
- need to chain together amino acids & “finish” & “ship” the protein

- ◆ make more cells

- need to copy DNA & divide it up



Our organelles
do all those
jobs!



**That's my
cellular story...
Any Questions?**